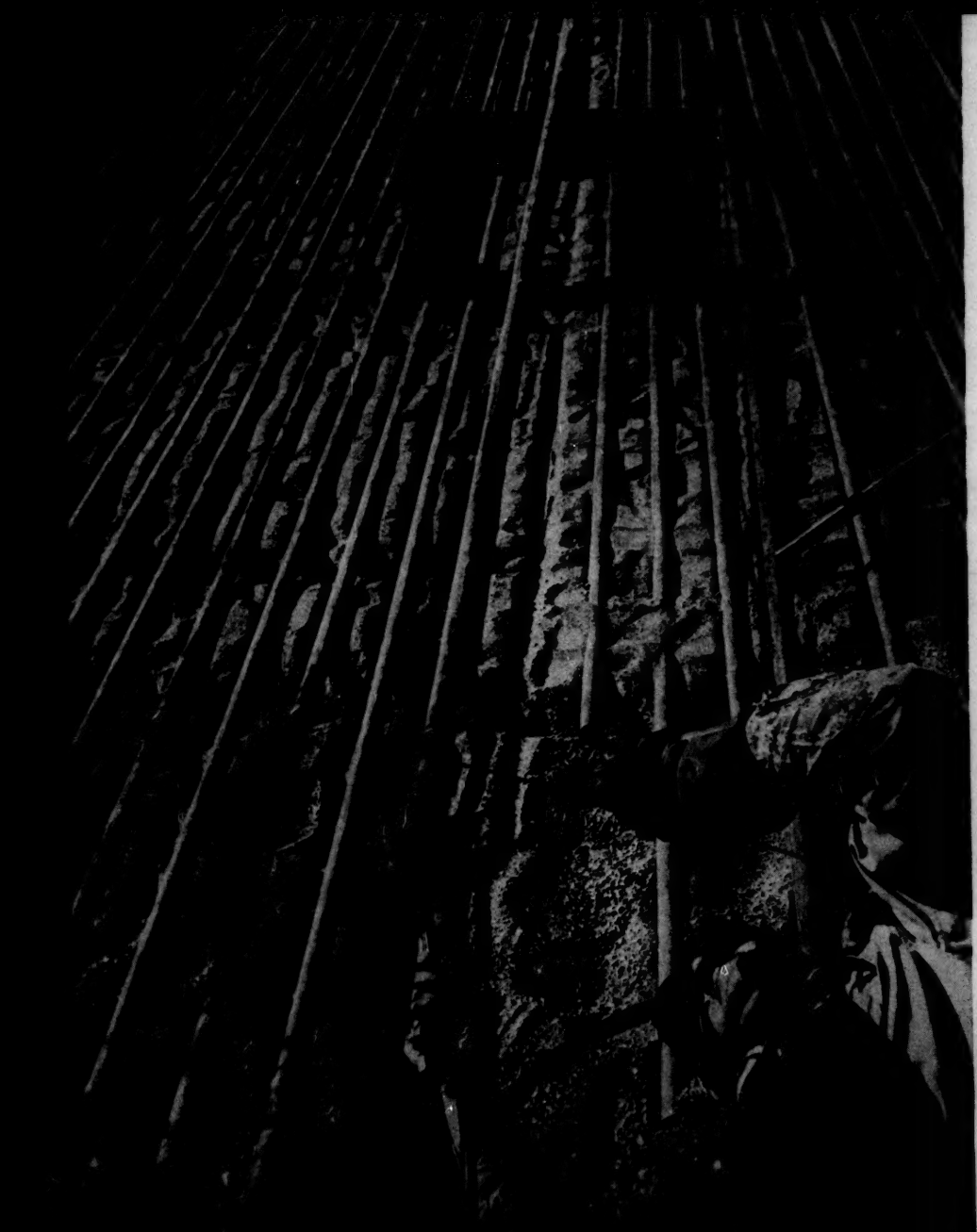
MARCH
1960

Industrial Refrigeration



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COVER—One of the four skating rinks at Squaw Valley under construction. See page 12.

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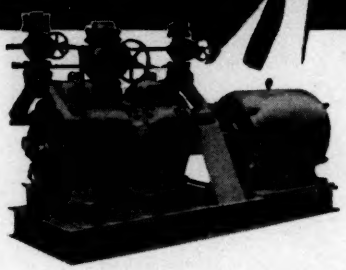

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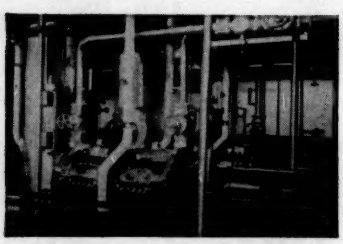

Another YORK Trail Blazer Concept Proved In Action
Detroit Refrigerating Div., Beatrice Foods Co.—The 40-year old horizontal compressors in this 1,980,000 cu. ft. cold storage warehouse were replaced with York V/W units to provide more efficient, automatic operation. The new system maintains constant temperatures with little or no attention.

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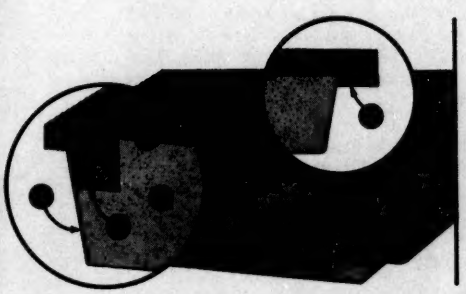

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B-R unit combines all the advantages of the gravity coil with the advantages of the fan type unit. The result of years of research and development, it is the evaporator that answers the problem when the installation requires that "extra" in performance.

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MANY APPLICATIONS: Can be furnished with a hot gas heated pan for temperatures below 30°. Available as an "F" or "L" THERMOBANK system with or without the compressor for temperatures of 32° or lower. The B-R designs include units for Refrigerant 12, Refrigerant 22 and ammonia.

Write for Bulletin R-482

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Industrial Refrigeration

March 1960

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ADVERTISING
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INDUSTRIAL REFRIGERATION, Published monthly at 433 N. Waller Ave., Chicago 44, Ill., U.S.A., by Nickerson & Collins Co. Yearly subscription in the U.S., $5.00 per year; other countries, $7.50. Single copies, $1.00. Copyright 1960 by Nickerson & Collins Co. Acceptance as controlled circulation publication at Chicago, Ill., and Pontiac, Ill.

CHANGE OF ADDRESS—Notify publisher and your local post office promptly of change of mailing address to avoid non-receipt of copies. Copies incorrectly addressed, because of failure to notify publisher, cannot be replaced. Upon request, post office will provide, without cost, convenient "change of address" mailing cards.

Industrial Refrigeration is indexed regularly by Engineering Index, Inc., and is microfilmed for library use by University Microfilms.

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- Comfort Cooling and Heating (Heat Pump)
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Published Monthly by NICKERSON & COLLINS CO.
General Offices: 433 N. Waller Ave., Chicago 44, Ill.
Telephones: AUstin 7-1303-04-05

69 Years of Continuous Publication

Standards Would Not Be Standards Without Refrigeration

WHEN most folks think of the word "environment" they picture the primitive existence of jungle life—or possibly the problems surrounding a man in space.

However, at the Electronic Calibration Center of the National Bureau of Standards, the word describes the physical conditions in the Center itself. And the primary interest is not how this environment affects people or other forms of life but rather how it affects the scientific standards and instruments which are used as master gauges for all electrical measurements.

The Electronic Calibration Center compares top electronic standards of industry and the military with the national standards maintained by NBS. These calibrations are extremely sensitive to environment. Rigid control is necessary to be sure that a calibration made today is comparable with one made a day, month, or year from now.

Wilbert F. Snyder, Assistant Chief of the NBS Electronic Calibration Center in Boulder, described these environment problems at a meeting in Huntsville, Alabama, of the Standards and Metrology Division of the American Ordnance Association.

Snyder discussed the care taken by the National Bureau of Standards to avoid adverse effects by temperature, humidity, dust, vibration, and electromagnetic fields. Electronically speaking this environment is more than "hospital" clean.

Air within the building is filtered continuously and the temperature is maintained at 73.4° Fahrenheit to a tolerance of 1.5°. This control is stable enough for most of the calibrations. Saturated standard cells, however—used in Boulder to maintain the volt—are kept in 85 gallons of mineral oil at a temperature which does not vary more than 0.001°F.

Fourteen rooms in the Center are shielded to avoid interference by electromagnetic energy such as that from radio broadcast stations, TV transmitters, sterics, and electronic equipment in general. Even though most of these rooms are as big as a small house—1,100 square feet—their walls, floors, and ceilings are papered with copper foil.

They have no windows and the copper-covered doors have special strips to seal the joints between door and frame. Fluorescent lights are placed in recessed metal boxes and the openings are covered with an aluminum screen. This same screening is used to cover every air-conditioning duct in these rooms.

In some measurements vibration is a critical factor. Thus, for delicate instruments such as a galvanometer the Center has large concrete piers which come up through the floor. The pier foundations are set in beds of sand beneath the building.

Relative humidity is kept at 50 per cent for several reasons: (1) on a national scale it approximates the average value of humidity in non-airconditioned laboratories, (2) in air-conditioned laboratories it is an economical value to maintain, (3) it is below the corrosion point of steel.

The contrast in the problem of maintaining humidity is shown by the fact that to control humidity at 50 per cent in Washington, D. C., the air-conditioning equipment must remove water from the outside air about nine-tenths of the year; in Boulder the equipment must add water about nine-tenths of the year.

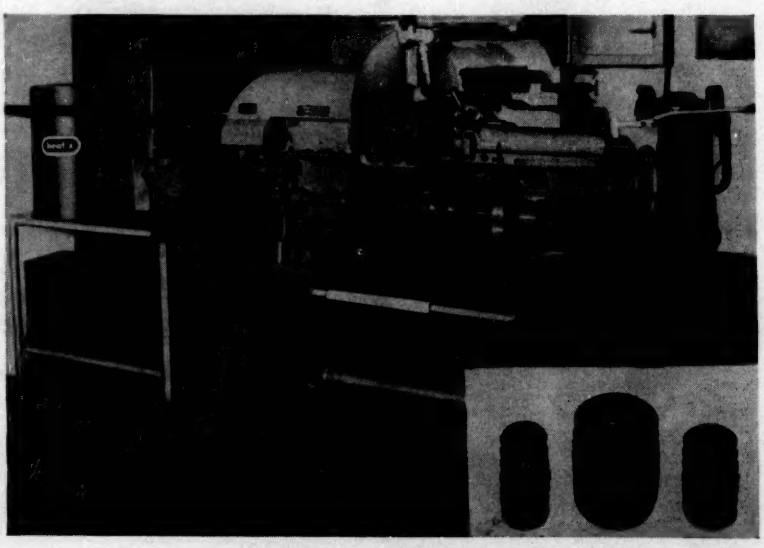
Two independent wiring systems are used to supply electricity to the laboratory areas—one regulated, the other unregulated. Voltage on the regulated line is maintained to a stability of 0.03 volt by a motor-generator control.

Snyder will point out that another aspect of the environment is the handling of the standards themselves. A standard with a long history of good stability is an irreplaceable "yardstick" of measurement.

CONTROL OF COOLANT TRIPLES PRODUCTION IN MACHINING TENITE

»» IF machined at too low a temperature, Tenite becomes brittle. Machining at too high a temperature permits softening, with resultant loss of precision and eventual fouling of tools. And in this application at Miggins Screw Products, Inc., Brewster, N. Y., the close tolerances which are required (plus or minus .002" on the O.D.) dictate a high degree of machining stability.

To increase production and improve quality, the company installed a cast aluminum liquid cooler with separate condensing unit. The coolant (water with a rust inhibiting agent added) is maintained at a constant temperature of 58°F. This accurate temperature control has permitted upping the production rate from 350 to 1,110 pieces daily—more than triple. Heat-X coolant coolers are made by Dunham-Bush, Inc.



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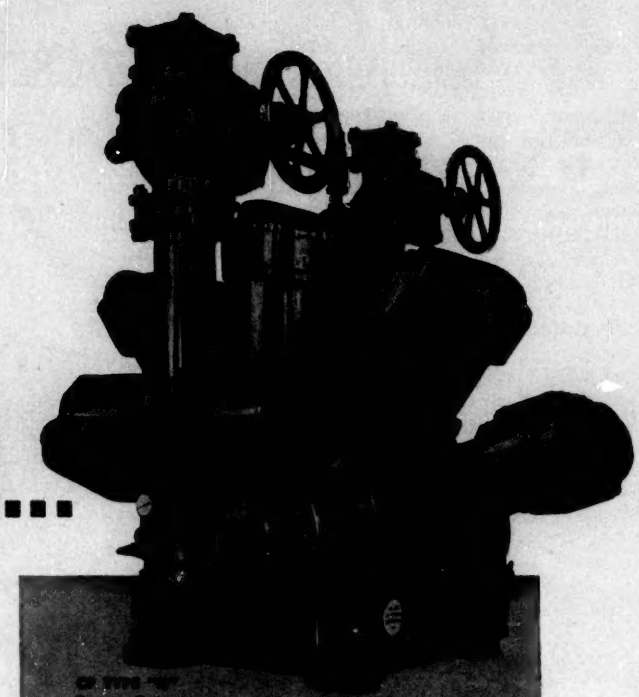

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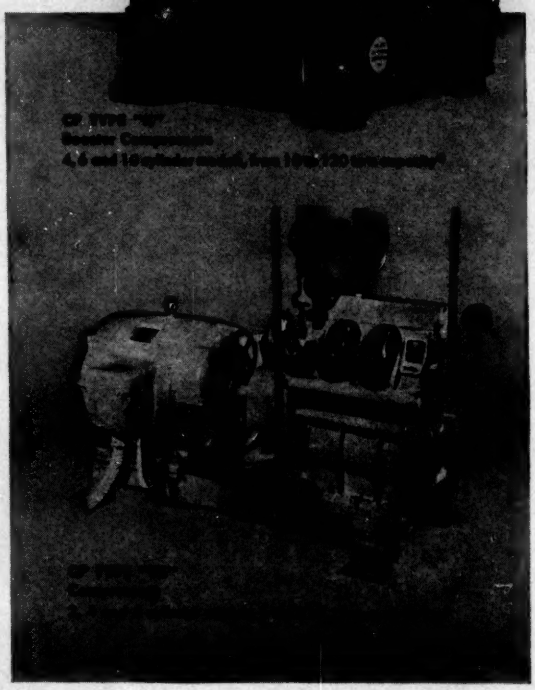

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news briefs of the month

More Research Answers Needed On Food Radiation

When the Army stopped construction of the food radiation pilot plant at Stockton, California, it was because many basic research answers needed before pilot construction could be accomplished, were not yet available. It was not because this method of food preservation is a dead issue. There is a difference between Army research and industrial research. Army emphasis is on high dose sterilizing treatment leading to storage without refrigeration. Industrial research is in the direction of low dose pasteurizing treatment used in conjunction with refrigeration. Progress toward the latter goal is moving along slowly but surely.

Cold Gyroscope Aids Missile Accuracy

Initial work on a super-frozen gyroscope that could make missile firing at least five times more accurate and permit submarines to stay submerged almost indefinitely has been completed by scientists. The new gyroscope grew out of the study of temperatures approaching the absolute zero of 460 degrees below zero. General Electric research engineers were conducting the study.

Cows Produce More In Air-Conditioned Shelters

Cooperative research by the USDA and the Missouri Experiment Station at Columbia shows that air-conditioned dairy shelters may be profitable for dairymen if average daily temperatures and relative humidity are excessive for 60 days or more each year. The Missouri studies show that in a well-insulated, 100-cow, stall-type dairy barn, air conditioning could prevent a 10 percent decline in milk production on days when outside temperature is 80 degrees and the relative humidity higher than 75 percent.

Refrigeration Needed to Provide Reliable Winter Sports

Many communities are discovering that refrigeration and artificial ice are the best way to assure reliable winter sports which are so often dependent on the vagaries of weather. Detroit now has eight outdoor ice rinks with ice reliably provided for six months out of the year by refrigerating machines. It also has five ski hills located 17 miles north of Pontiac with guaranteed skiing for 100 days a year. Thanks to artificial snow. Other cities utilizing refrigeration to provide reliable winter sports are New York, Chicago, St. Louis, Baltimore, Denver, Boston, Kalamazoo, and many other smaller cities. Even Canadian cities such as Toronto, Quebec and Winnipeg, where weather conditions are more reliable, are using refrigerated ice rinks. About 450 refrigeration plants have been installed in six years in Canada for this purpose.

Absorption Units Gaining Favor

A wider selection of heat-operated absorption refrigerating machines is now coming on the market. These new systems will feature new controls that reduce operating costs. 20 sizes ranging in capacity from 50 to 1,000 tons will be available. A new solution valve control system resulting from more than two years of research is a part of the new design and will probably result in lower steam consumption when operating at partial capacity. It also controls cooling process by reconcentrating only enough salt solution to match the refrigeration load, electronically by-passing the rest. The new control method permits the machine to return from low to full capacity much more rapidly. The new line of machines is announced by Carrier Corporation.

Cold Storage Preserves Christmas Tree

Just out of curiosity a Spokane, Washington resident placed her 1957 Christmas tree in cold storage between seasons. It was used for the third time last Christmas. Frank J. Congdon, manager of the Empire Cold Storage Co., Spokane, kept the tree at zero degrees between Christmas seasons. The tree grew more fragrant with age, however, it did lose its bright green color, according to the owner, and last Christmas was the last time it could be used.

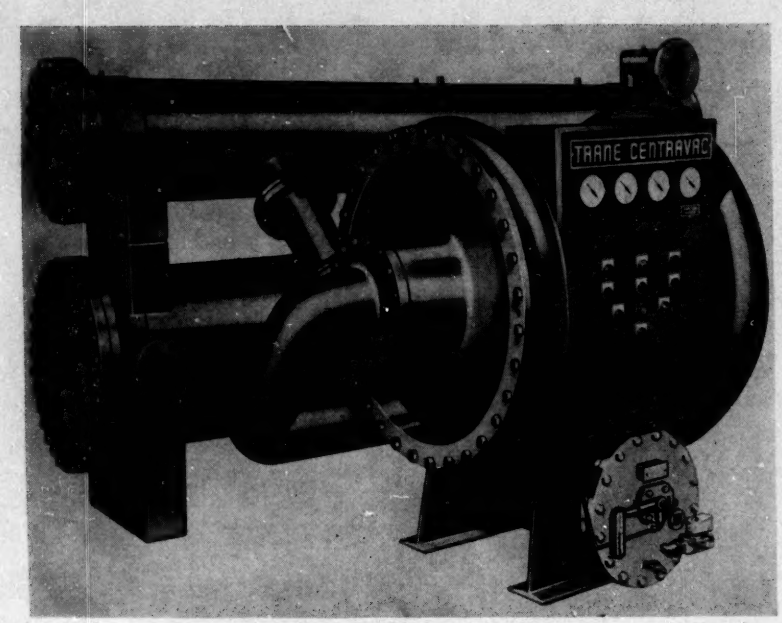


Fig. 1 — 50 to 70 ton centrifugal

Centrifugal Refrigeration Equipment

By M. L. HOGLUND

The Trane Co. LaCrosse Wis.

Part 1 of a 2 part article.

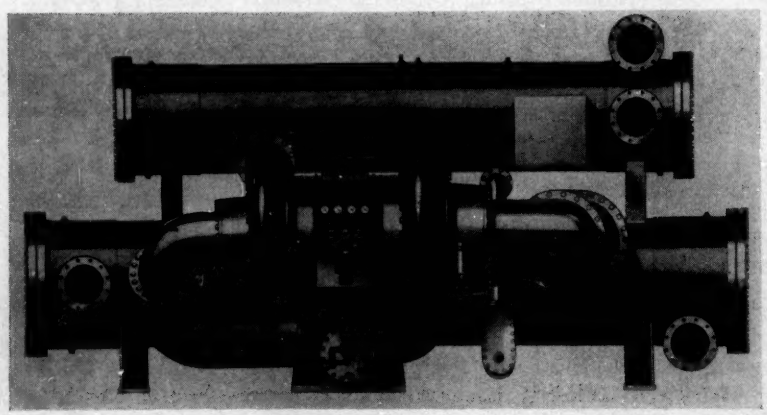


Fig. 2 — 640 to 1300 ton machine

How It Is Constructed.

»» All centrifugal refrigeration units, as we know them today, are refrigeration machines that produce chilled water. They are all built with water cooled condensers. These units, therefore, consist of three basic parts, a compressor with its driver, and two water-to-refrigerant heat exchangers that are commonly known as an evaporator where the water is chilled, and a condenser where the heat is rejected. There are, of course, the necessary interconnecting piping and fittings between these three parts and the controls that are required to make a functioning unit.

While we speak of centrifugal refrigeration, this is probably not technically correct. The refrigerant cycle itself is no different from any other refrigerant cycle that is used with a reciprocating compressor although the properties of the refrigerant are different because of the nature of the design of the machine. We can say, therefore, that the refrigeration cycle is not centrifugal, only the compressor. In a centrifugal, to achieve compression, gas is whirled at a high speed by an impeller or impellers and the velocity so generated, is translated into static pressure as contrasted with the squeezing action that is so familiar in the reciprocating compressor.

While turbine driven centrifugals are available, most jobs being installed today using centrifugal refrigeration machines will use an electric motor driven hermetic unit. It is to the latter machine that this paper will be devoted.

The range of sizes that this machine is available in ranges from 50 tons, in the smaller size shown in Fig. 1, up to 1300 tons, shown in Fig. 2.

The compressor of these units employs a 2-stage balance thrust design. It has prerotation vane capacity control ahead of each compressor stage which results in a broad partload range from 10% to 100% capacity and efficient partload operation, the power requirement following the output very closely.

A simple squirrel cage electric motor of the constant speed type is used. This motor operates in the refrigerant atmosphere so there is no shaft seal to maintain or through which refrigerant can be lost.

The hermetic machine is quieter in operation than the turbine. It is designed to mount on a flat and level floor so cost of installation is reduced to a minimum. This type of machine can be used in all applications. It can be located almost anywhere in the building from the usual equipment room in the basement to the penthouse on the roof of a building.

Cycle Of Operation

Water to be chilled passes through evaporator tubes and heat is transferred to the liquid refrigerant as shown in Fig. 3. As the heat transfer takes place, refrigerant boils and turns into a gas. A higher vacuum in the evaporator will lower refrigerant boiling temperature. Gaseous refrigerant is then drawn upward through eliminators to remove any entrained liquid. It is then pumped into the compressor. In the compressor, the gas is compressed, by centrifugal action, to condenser pressure. The gas is then discharged from the compressor into the condenser. In the condenser, a reverse cycle takes place—heat is withdrawn from the refrigerant gas by condenser water flowing through the tubes. Gas is condensed to a liquid which flows to the evaporator through a liquid line and is metered by an automatic float valve. In returning to the evaporator, the refrigerant has completed a single cycle and is ready to cool more water.

The flash gas generated in the flash tank is drawn into the second stage of the compressor and, therefore, this volume of gas must be handled only by the second stage. This accomplishes an increase in the over-all capacity of the machine as the first stage does not have to handle the flash gas from the economizer, therefore, it draws more gas from the evaporator. This increase in capacity is accomplished without increasing the horsepower that is required to drive the compressor.

If it is desired, the machine can be made to operate at no increase in tonnage output with a reduction in the power input to the machine.

An economizer used on a 2-stage machine will affect the machine performance 2 to 5% depending upon the head that the compressor operates against. For a machine selected to produce 44° leaving chilled water with 95° leaving condenser water, the increase in capacity without increase in horsepower is approximately 4%. If no increase in capacity is desired, then the horsepower would be reduced in a like amount.

Operation With Economizer

Fig. 4 is similar to Fig. 3 with the exception that a flash tank has been inserted in the liquid line between the condenser and the float valve in the liquid line at the inlet to the evaporator. This device is called an economizer.

The flash tank portion of the economizer is connected by a line to the crossover pipe between the first stage of compression and the second stage of compression. The purpose of the economizer is to cool the liquid flowing through the liquid line to a temperature equivalent to the intermediate pressure between the first stage and the second stage. The liquid refrigerant flowing between the condenser and the evaporator cools itself by evaporation or flashing as the pressure intermediate between the two compression stages is lower than the condenser pressure.

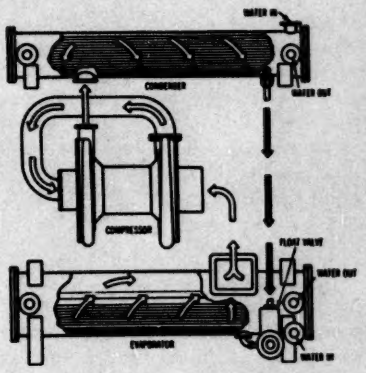


Fig. 3 — Refrigeration cycle of operation

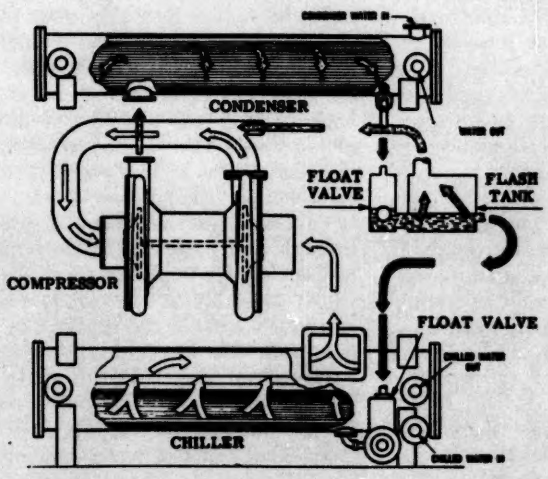


Fig. 4 — Cycle of operation with economizer

Fig. 5 — Properties of Refrigerants for Centrifugal Compressors

	Boiling Point At 1 ATM.	Pressure at 40° Evap.	Pressure at 100° Cond.	CFM/Ton at 40° Evap.
R 11	74.78° F	15.0" Hg. Vac.	8.90 psig	15.82
R 113	117.63° F	24.3" Hg. Vac.	8.59" Hg. Vac.	38.37

Properties Of Refrigerants For Centrifugals

R-11 and R-113 are the most widely used refrigerants in centrifugal compressor design. In Fig. 5 are indicated the physical properties of these refrigerants. In the first column is the boiling point at atmospheric pressure. This is also shown the evaporator pressure equivalent to 40° evaporator temperature and the condenser pressure at 100° condensing temperature. These are common design and operating points. The slide also shows the cfm per ton that the compressor must handle when the refrigerant is evaporating at 40°.

R-11 is the most widely used refrigerant in centrifugal machines. It is the common refrigerant for those tonnages that range from 150 to 1500 tons. It boils at atmospheric pressure at approximately 75° in a normal machine. The evaporator is under 15 inches of vacuum while the condenser is operating at approximately 9 lbs. positive pressure. It is obvious, then, that the cycle straddles the atmospheric pressure line, the evaporator being under vacuum and the condenser being at positive pressure. This means that leaks in the evaporator would cause the air to leak in while leaks in a condenser would cause refrigerant to leak out.

The compressor must handle approximately 16 cfm per ton.

Refrigerant-113 boils at approximately 118° at atmospheric pressure and the complete cycle operates under vacuum. The evaporator operates at 24 inches of Mercury vacuum approximately and the condenser at approximately 9 inches of Mercury vacuum for the conditions shown. The compressor must handle more than 38 cfm per ton.

Any leakage into an R-113 machine will be air into the cycle, not refrigerant out of the cycle. The high cfm per ton for R-113 is what has made small tonnage centrifugal compressors practical.

Head Pressure And Capacity

Fig. 6 compares the head requirements and the cfm per ton for the two refrigerants R-11 and R-113. The heads that the compressors must develop are not too different, but the cfm per ton are considerably different.

HEAD AND CAPACITY FOR REFRIGERATION

F-11 vs. F-113 (40° Evap., 100° Cond.)

F-113		F-11		F-113/F-11	
Head Ft.	Capacity CFM per ton	Head Ft.	Capacity CFM per ton	Head Ft.	Capacity CFM per ton
5874	38.37	6901	15.82	.85	2.43

Capacity — CFM

Tons	F-113	F-11
50	1919	791
100	3837	1582
150	5756	2374
200	7675	3165
300	11512	4747

Fig. 6

Referring to the table headed capacity-cfm, if 2000 cfm is the minimum gas volume that a 2-stage compressor can be designed for, considering an operating speed of approximately 3600 rpm which is used on all hermetics, it can be seen why refrigerant R-113 is used only in a limited range. As far as The Trane Company is concerned, we use R-113 in the 50-125 ton capacity range and R-11 for the higher tonnages. This is done because there is an advantage in the cycle efficiency of R-11 which effects the over-all efficiency of the machine. This brings us to Fig. 7 on cycle efficiencies for different refrigerants.

Cycle Efficiencies

In order to evaluate the relative merits of different refrigerants, the cycle efficiency is determined. It is known that no refrigerant cycle can be better than a Carnot cycle. The Carnot cycle, as may be remembered from school days, is an ideal cycle and better than any cycle that could possibly be used. The coefficient of performance for the refrigerant in question is determined assuming the compressor efficiency to be 100%. The coefficient of performance is then divided by the coefficient of performance for the reverse Carnot cycle, operating between the same temperatures.

Fig. 7 shows the cycle efficiencies of several important refrigerants. Here we see that R-11 and R-113 are both more efficient than R-12 and that R-11 is better than R-113. It also shows that R-11 with economizer is almost perfect.

This leads us directly to a discussion of compressor performance which I would like to consider next.

Compressor Construction

Fig. 8 shows a Trane Centrifugal that has had various parts cut away. In it you see the condenser, tube bundle and the evaporator tube bundle with the liquid eliminator above it.

In the cutaway of the compressor you see the first stage of compression. The volute and suction cover has been cut away to show the impeller and the prerotation vane assembly ahead of the impeller. The prerotation vane assembly is very important to the wide capacity range and the efficient performance at part load.

Fig. 9 shows a drawing of a section through the compressor and motor assembly. Note the motor in the middle with its bearing and shaft. The motor has shaft extensions on both ends, and the impellers are mounted directly on the motor shaft. Then ahead of each impeller stage is the prerotation vane damper, the position of which is actuated from the outside through a bellow seal so there is no packing. Under the compressor-motor assembly is the oil sump wherein is located the separate oil pump for the lubrication system.

The motor shown in this drawing is typical of the motors from 50 hp through the 420 hp size group that employ water cooling

to take care of the inefficiency heat of the motor. The water jacket is around the outside of the motor and uses chilled water. The amount of chilled water required is small.

The motor is designed with what the engineers call a "stiff shaft." This means that the first critical speed is above the operating speed. In the case of our machines, the first critical speed on the motor shaft is approximately 4500 rpm, while we operate at 3600 rpm. The shaft is mounted in simple sleeve bearings.

It is possible to use two simple sleeve bearings because of the way we designed the compressor. The impellers are mounted directly on the motor shaft, and are back to back so the thrust inherent in each impeller is counter-balanced against the thrust of the other impeller. Thus, we do not need a complex thrust bearing that requires high maintenance, nor do we need a balance piston in the compressor design. What little unbalanced thrust there is, is taken on a small thrust collar of the sleeve bearing. Because we move both prerotation vane dampers simultaneously, at no time do we upset the balance of thrust from the impellers.

Oil is supplied to the two compressor bearings through the two lines that come from the top of the motor housing. It is delivered to the bearings under pressure that is created by the oil pump that is located in the sump below the motor. This oil pump operates submerged in the oil so it will not lose its prime. Controls are provided on the machine so it cannot start until there is oil pressure to the motor bearing. This we feel is important since design engineers agree that 95% of bearing wear is due to improper oil film, which condition does occur at the time of start-up if a shaft-driven oil pump is used. The oil drains out of the bearing housing by gravity back into the oil sump. The lines are not shown in Fig. 9.

The motor is a squirrel cage type motor designed specifically for centrifugal operation. It is a 2-pole motor designed with minimum slip so it operates at about 3550 to 3570 rpm. The windings are impregnated with a Bakelite varnish that is not affected by the refrigerant. Since it operates in a clean, dry refrigerant atmosphere and it is either cooled by water or gas as is the case with the larger motor, it operates under a constant temperature. This assures minimum maintenance as far as the motor is concerned and long trouble-free life. The rotor and shaft are balanced both statically and dynamically in manufacture, and the impellers are also in static and dynamic balance so that the assembly is in dynamic balance and runs

Continued on page 29

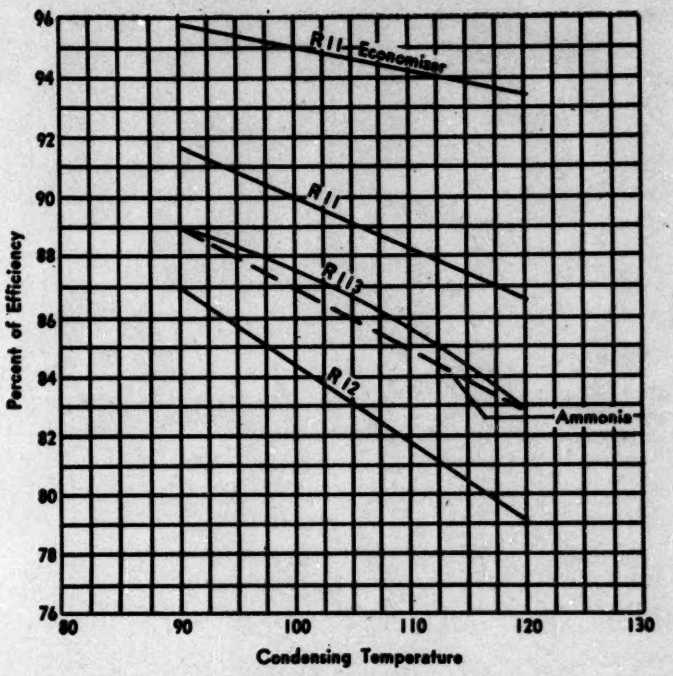


Fig. 7 — Cycle efficiencies for different refrigerants at 40° suction temperatures

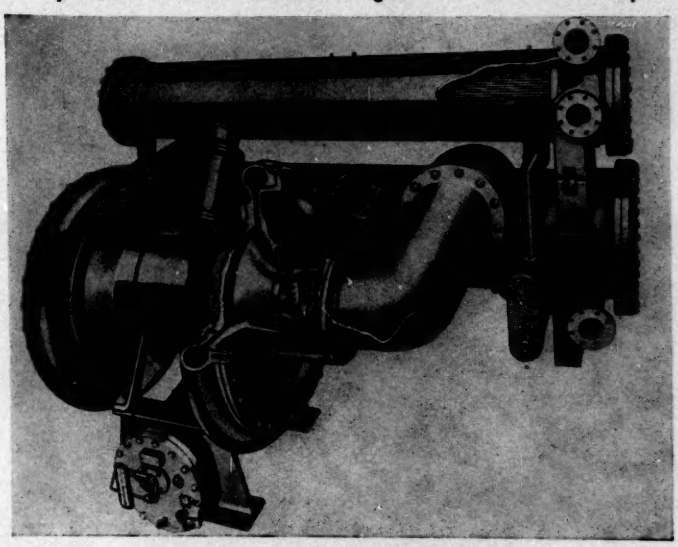


Fig. 8 — Cutaway view of compressor

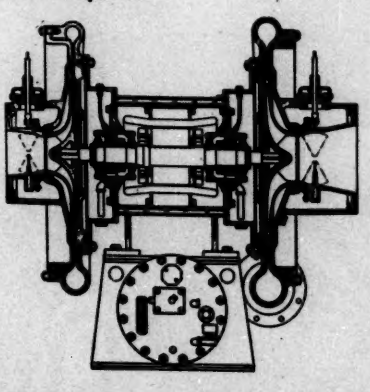
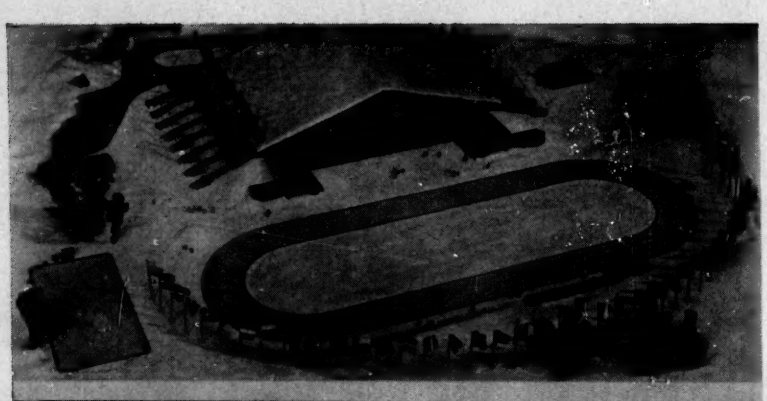
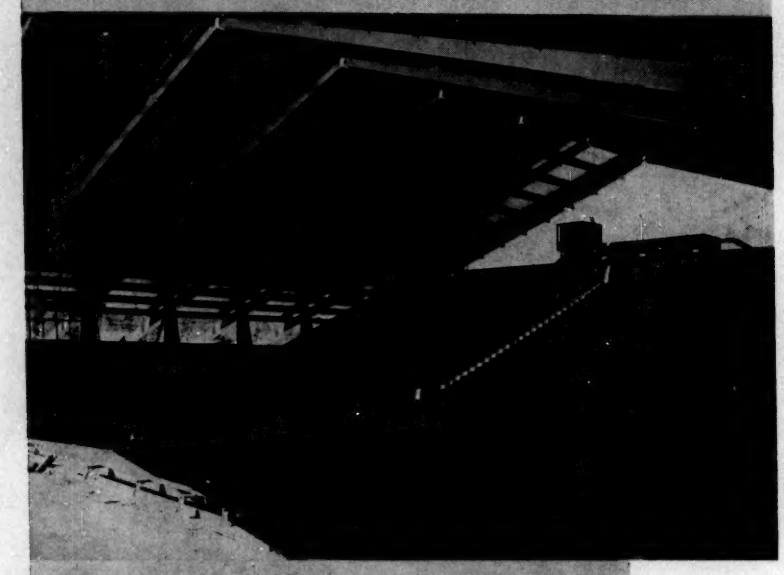
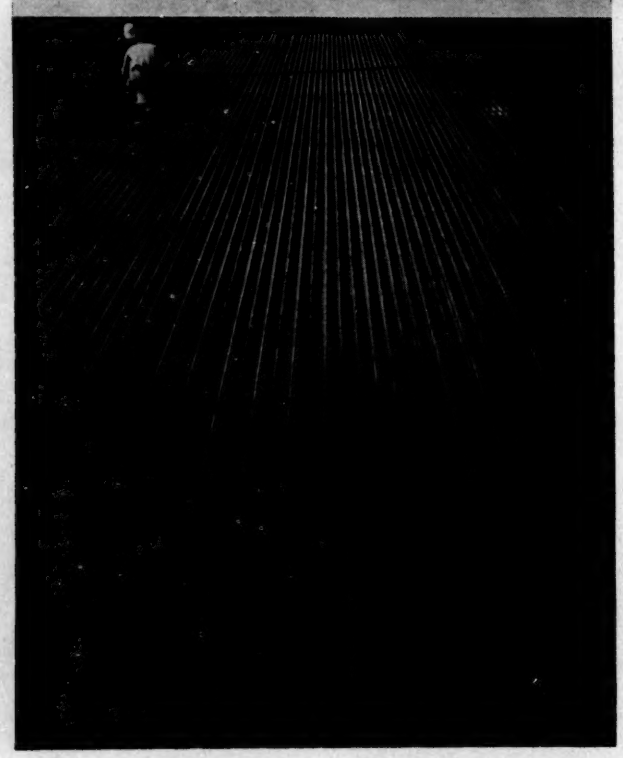


Fig. 9 — Cross section of compressor







550 Tons Refrigeration Freeze Four Squaw Valley Skating Rinks

»» THE half a million or more spectators who traveled to Northern California's famed Squaw Valley to witness the 1960 Winter Olympic Games enjoyed the unique distinction of being warmed by the very same system which cooled the ice skating rink surfaces to freezing temperatures!

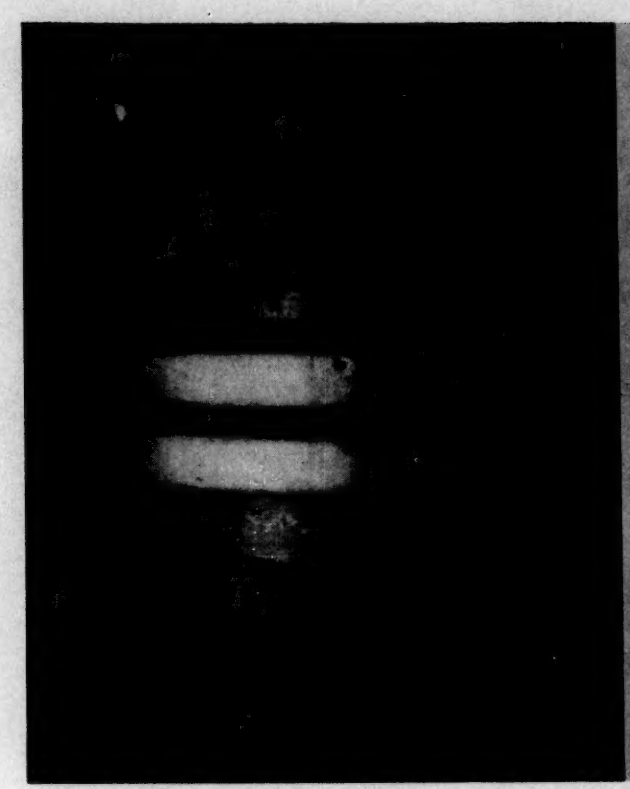
The Gay Engineering Corporation of Los Angeles installed the entire refrigeration and rink system, providing 120,000 square feet of skating surface for the international skating competition.

The unique refrigeration system, designed by the York Equipment Co. for the 4 man-made arenas at the $15,000,000 Squaw Valley project, not only served to provide the freezing temperatures for the rinks, but also contained a reverse cycle heat pump system which blew warm air through the cellular steel decking of the main arena to melt and slide snow from the roof and

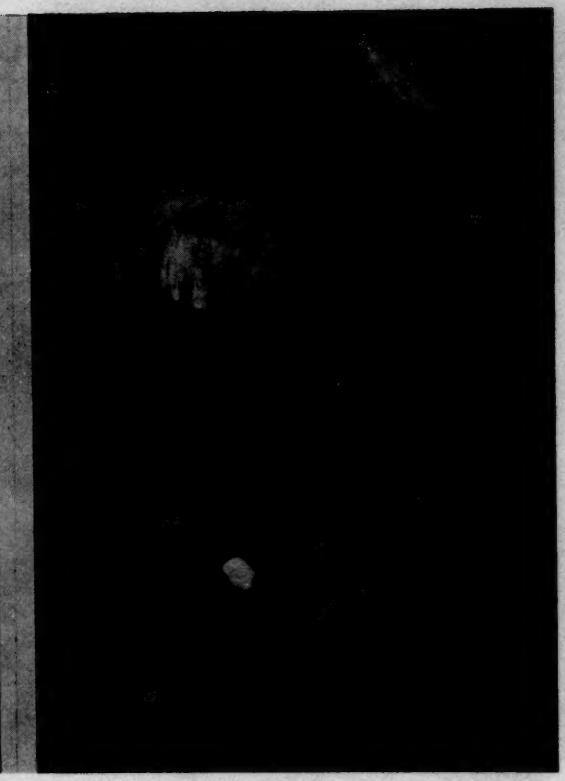
View of the 8,000 seat ice arena at Squaw Valley, top photo, representing the biggest concentration of artifically frozen rinks in the world.

Interior view of arena during laying of pipe for the rink is shown in center photo.

Bottom photo—Nearly 11 miles of 1¼ inch diameter pipe was installed by the Gay Engineering Co. of Los Angeles in the ice rink floor of the international arena at Squaw Valley for the just concluded 1960 Winter Olympics Games. The entire system of pipe and refrigeration for the main arena and 3 other rinks was handled by Gay.



Expansion joints were used in the mains serving the 4 rinks. Both arc and acetylene welding was used to join the miles of thin walled pipe used in the 4 ice skating rinks.



Pipe in the pump room was covered with 1½ inch layer of fiberglas insulation, wrapped and coated with an asphaltic compound. Two pump units served each of the 4 rinks.

warm the spectators inside the arena.

The steel framed ice arena houses a permanent 16,150 square foot ice rink. The building is enclosed on 3 sides and accommodates 8,000 seats under a 300 foot clear-span roof. Spectators seated in the grandstands were able to watch two to four events at one time.

The south side of the structure was left open and looks out on the speed skating oval and the ski jumps. In addition to the two main arena rinks, two other 17,000 square foot practice rinks were installed.

The 400 meter speed rink and the two practice rinks were temporary installations. But the ice rink in the main arena will be a permanent installation. It was designed by San Francisco architects Corlett & Spackman and Kitchen & Hunt.

A 5" concrete slab was used for this ice rink. Imbedded in the slab is 1¼" diameter pipe, for refrigeration. At Squaw Valley, Gay Engineering used 11 miles of pipe.

The heart of the pumping system serving all 4 rinks was located in an equipment room below the main arena grandstand, which also is the site for a 40,000 gallon capacity brine tank installed immediately beneath the equipment room.

Temperature controls, which adapt the freezing action automatically to all of the rinks and at the same time channel heat to the roof for snow control, were specially designed for the Winter Olympics by Minneapolis-Honeywell.

The system controls the freezing of each rink from two locations, in addition to a central control board. Each rink has its own pumping system, picking the refrigerant up from mains connecting the rinks via tunnels.

The system will cool 5,500 gallons of brine per minute to minus 5 degrees or 550 tons of refrigeration per hour. The rinks were load tested at 150 pounds per square inch.

The pipe was installed on 3½ inch centers and there are 293 such pipes, each 196 feet long, in the arena floor. Both electric resistance and acetylene welding were used in the pipe installations for the rinks.

Welders did their piping out on a rack adjacent to the arena rink, welding sections to the proper length and then installing the lengths over wire supports or chairs. The lengths were welded into the main with a control valve for every two lengths.

When the main arena pipes were laid and tested, a monolithic pour of concrete 1¼ inch thick, was set over the pipe. The rink was isolated from the rest of the arena floor by expansion joints. The main arena rink, incidentally, accommodates about one inch of ice.

Piping in the speed and practice rinks was left exposed, in a bed of sand. The first step in freezing the rink was to deliver water in a fine spray. This impregnates the sand base to carry a water fill which is then added to freeze the entire area.

Pipe in the distribution lines and mains ranged in diameter from 12 to 16 inches.

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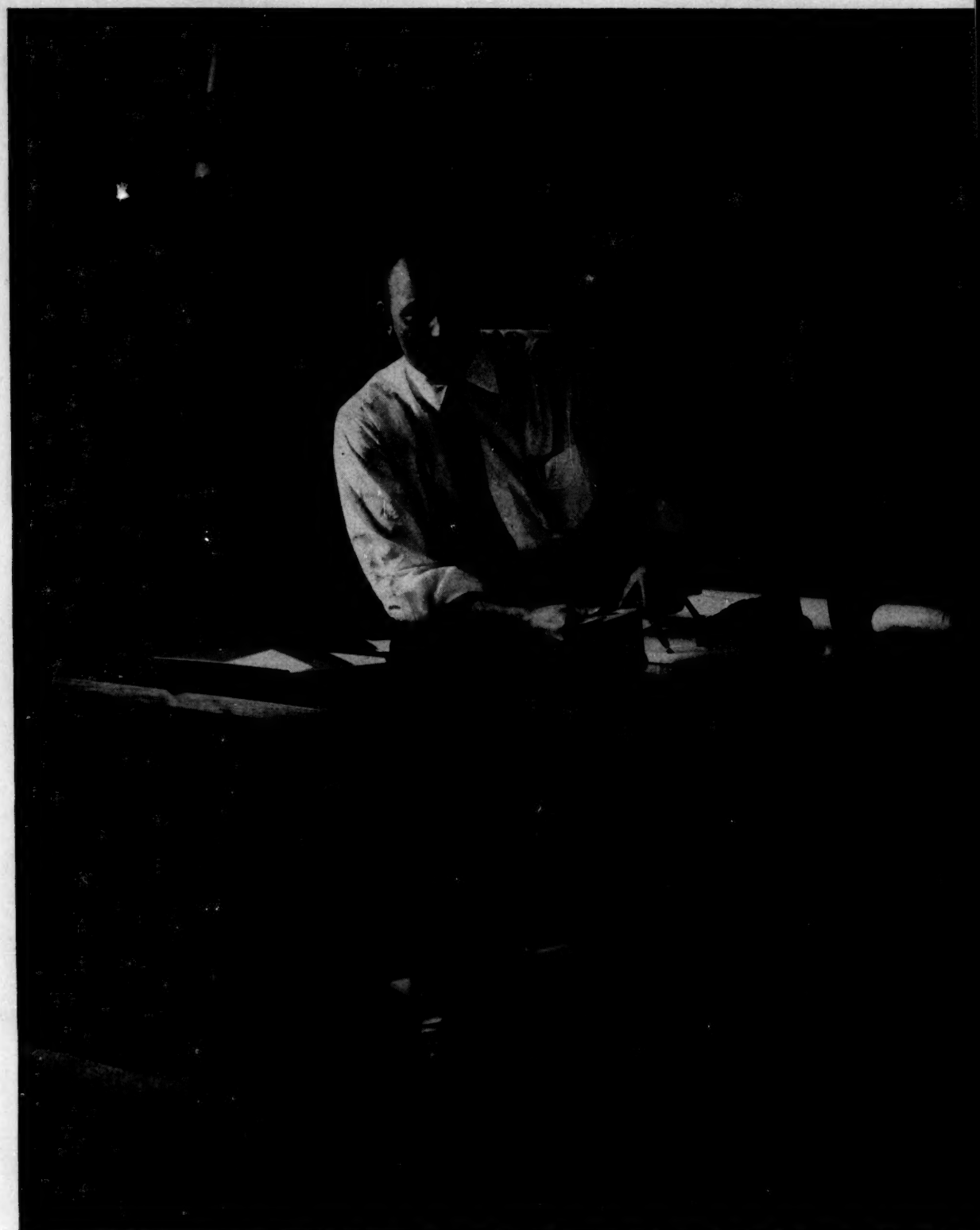

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Fig. 1. View of crushed ice making installation in the Dinuba, Calif. plant of Western Turkey Packing Co., a division of National Storage Co. The plate ice maker is installed in upper part of tall structure (center). Ice bin with rake is in lower part. Note supply conveyor at lower left end.

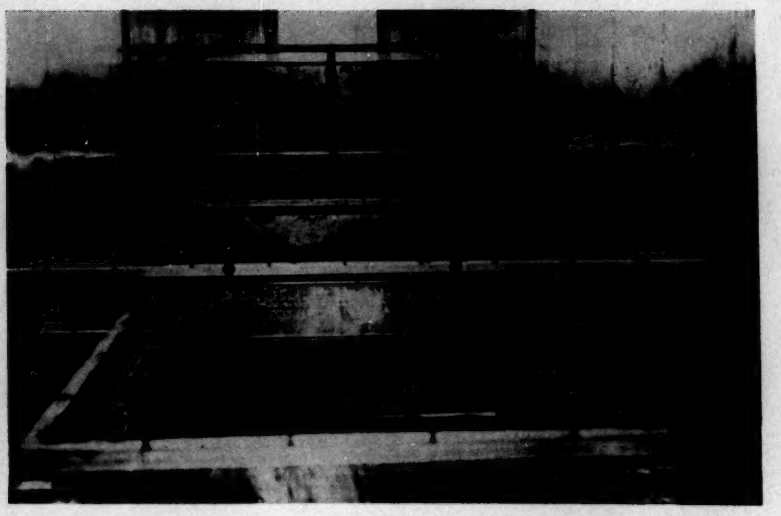


Fig. 2. Cable supported ice rake in California poultry processing plant levels ice in bin. A rake hoist adjusts the rake to ice level and raises and lowers it in accordance to ice level and rate of dispensing.

Crushed Ice As A Primary Refrigerant

Food processors requiring prepared forms of ice find "on the premise" ice makers an advantage.

By FRED A. HERR

»» NEW developments in the direct manufacture of crushed ice and its utilization as a primary refrigerant in the fish, sausage making, poultry, vegetable and fruit industries, rail car and truck top icing, concrete aggregate mix, etc. were discussed at a recent meeting of refrigeration engineers by Charles R. Kohlenberger, president, Kohlenberger Engineering Corp., Fullerton, Calif. The speaker restricted his comments to equipment which freezes ice directly with the refrigeration on one side and the water on the other side of heat exchange surfaces. The first such machine, he explained, was a wet slush unit wherein the ice was frozen in the form of a wet snow or slush. Various types of drum machines then were developed with which the ice is continuously frozen on low temperature rotating or stationary drums, and chipped, scraped, forced or "machined" from the drum, or on a flexible drum where the ice falls off as the drum flexes. This type of unit, according to the speaker, produced slightly sub-cooled ice which gained acceptance among many users.

"Prior to the development of the so-called drum machine," Kohlenberger said "came the machine which freezes ice on the inside of tubes by circulating water through them to form clear, non-sub-cooled ice in either cylinder form or crushed form. Somewhat later came the machine which made ice on the outside of verical flat plates; and then one which utilized the outside of vertical tubes. Such machines generally work on the same principle of flooded surface, utilizing relatively high back pressures and alternate freeze and harvest cycles."

Trend Toward "On Premise" Ice Machines

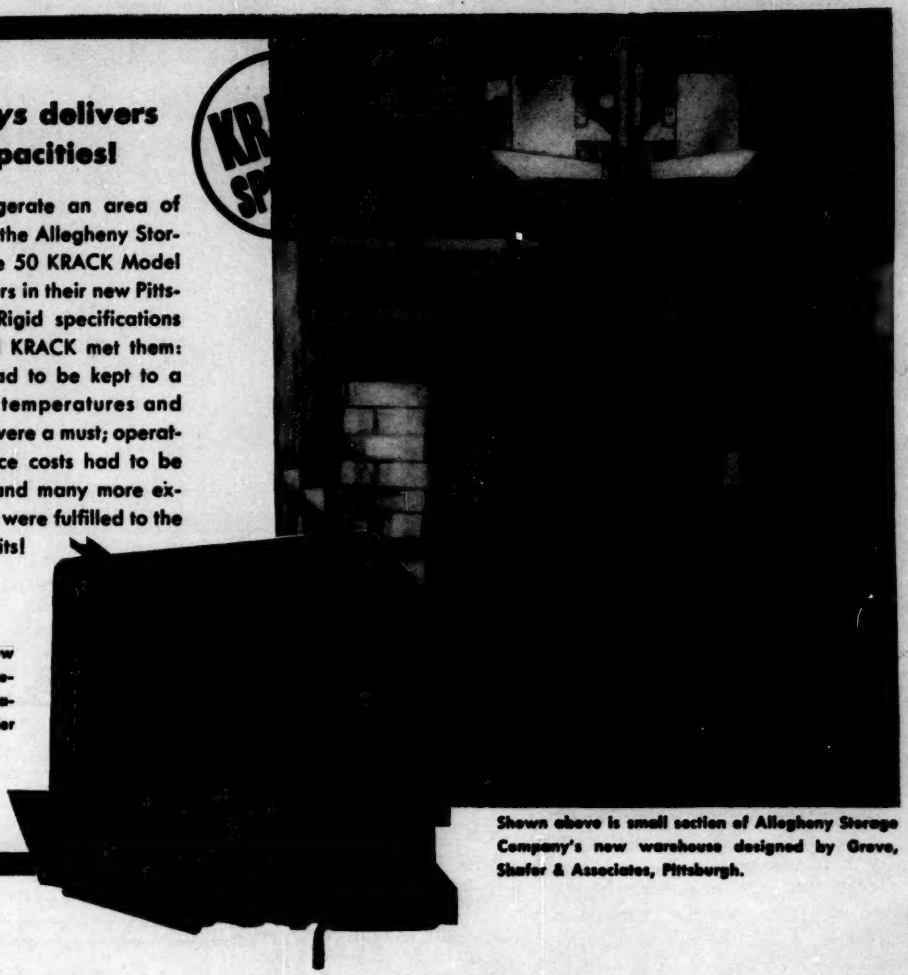
Kohlenberger said that in analyzing the most usable form of ice it is readily seen that crushed ice of some kind fills almost all ice needs, with the probable exception of rail car icing. He declared that with labor costs continuing to rise, the making of crushed ice directly, and storing, dispensing and delivering it automatically to points of use in the plant, is practically mandatory today in many industries. Rising labor costs, he pointed out, are accelerating the trend with many plant owners toward purchasing direct ice making machinery.

Plate Ice Maker Described

Kohlenberger described the plate ice maker as a direct-freezing crushed ice making machine which employs a series of hollow

KRACK *always* delivers rated capacities!

To effectively refrigerate an area of 52,848 square feet the Allegheny Storage Company chose 50 KRACK Model HG-1200-FLA Coolers in their new Pittsburgh warehouse. Rigid specifications had to be met and KRACK met them: initial investment had to be kept to a minimum; uniform temperatures and minimum velocities were a must; operating and maintenance costs had to be kept down—these and many more exacting requirements were fulfilled to the letter by KRACK units!



Model HG-1200-FLA Low Temperature Hot Gas Defrost Product Cooler features a hot gas coil under the drain pan.

Shown above is small section of Allegheny Storage Company's new warehouse designed by Grove, Shafer & Associates, Pittsburgh.

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. . . stores 18 million lbs. of frozen food at 0°F. and does it ECONOMICALLY with KRACK!

No lost stacking space—
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plates of polished steel, the interior of which evaporates the refrigerant while water sprayed over the outside freezes into clear sheets of hard ice.

"After a given freezing cycle, which depends on compressor capacity available," he said "a portion of the plates is harvested by closing the suction valve and forcing out the evaporating refrigerant with high pressure gas. The refrigerant is stored in the overhead accumulator and utilized by the other plates during the harvest, so that at all times part of the plates are freezing and part are harvesting. This differs from the other tubular ice makers which harvest all of the freezing surface simultaneously."

The speaker described how during the harvest cycle the sheets of clear hard ice fall into the breakers, are broken into small pieces and conveyed out of the machine through a perforated helical screw conveyor. The machine, he explained, is completely automatic and self-contained, including automatic valves, refrigerant piping, insulated panels and pan, and electrical control panels.

Ice frozen on the outside of the plate or tube can be varied in thickness, Kohlenberger explained, from 1/8 inch to 3/4 inch, whichever is most desirable for the user. Optimum thickness for maximum output is approximately one quarter inch.

Kohlenberger emphasized that the manufacture of the ice represents only a part of the problem for the larger user of crushed ice, because storing, dispensing and conveying constitute major considerations.

Fig. 3. View of poultry processing room in California plant, showing ice conveyor outlet (center). Elevated push button ice control station is seen to right of vertical spout which delivers crushed ice via conveyor from crushed ice maker and deposits it in wheeled hoppers.

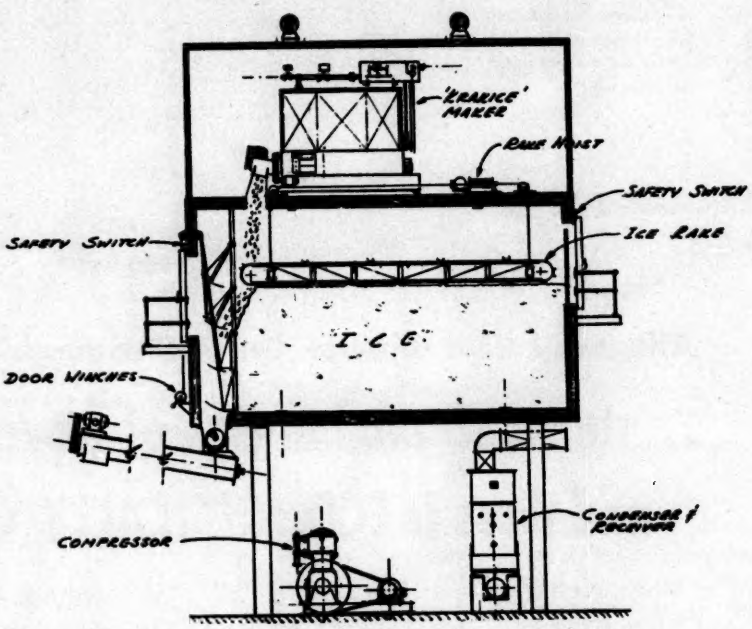


Fig. 4. Typical section through crushed ice making system.

Storage Bin Requirements

He cited the following requisites for practical storage of direct-made crushed ice:

1. Good design dictates placement of the insulated ice storage space beneath the ice maker in order to provide gravity flow of the ice into the bin. See Fig. 4.

2. Ice bin design boils down to a minimum size of at least one day's ice production. This utilizes capacity during off days which can be spread over using days. If peak demands are high and ice is not needed every day, the bin should be sized to take advantage of that condition.

3. Bins should be elevated to a point where the delivering screw conveyor is approximately 8 or 9 feet above floor level, Fig. 1. Consideration should also be given when compressor equipment is placed beneath the bin.

4. Bin construction using wood studs of sufficient spacing to carry the load of ice makers on the roof of bin has proven satisfactory.

5. Bin lining is usually of metal or resin impregnated glass cloth. The bin floor should be sharply sloped to a floor drain.

6. A cable supported ice rake is utilized for handling the ice in the bin for leveling and dispensing. The unit illustrated in Fig. 2 includes a rake hoist to adjust the rake to ice level and raise and lower it in accordance with the ice level and dispensing rate.

Rake Assembly Explained

Kohlenberger elaborated his commentary on rake assemblies by explaining that ice dispensing rake controls are now developed which position the rake in the ice so that during the production of ice, the rake levels the pile and raises itself to compensate and also lowers itself automatically to dispense ice. The rake assembly is designed to prevent burying of the rake in the ice at any time and is equipped with a shear pin on the rake drive to prevent accidents.

Kohlenberger stated that screw conveyors have given the best service for handling cracked ice as well as other types of crushed non-subcooled ice. Galvanized helical screw conveying units, he said, lend themselves to straightforward design for the delivery of ice throughout any plant operation.

"The 9 inch diameter size is probably the minimum size recommended due to the carrier bearing outside the screw which could cause blockage," he said. "This is especially true for conveying flake ice. The flights should be cut off short of the end of the trough and extend only half way through the discharge opening. This prevents plugging the conveyor and pushing off the trough end due to packed ice. The conveyor should be lightly insulated or equipped with drip pans to prevent objectionable dripping."

$2.70/Ton Cost of Crushed Ice

Kohlenberger stated that conservatively estimated figures on block ice at the user level come to approximately $5.00/ton, which varies according to area. To this should be added the cost of crushing and handling the blocks, approximately $1.00 for a total of $6.00/ton.

The cost of crushed ice manufactured directly, stored in a bin and dispensed automatically at the point of use would, at a conservative estimate, be $2.70/ton, according to Kohlenberger. That figure, he said, includes first cost, cost of equipment, amortization costs, taxes, depreciation, insurance, water, power, maintenance and operating costs.

Space requirements for a crushed ice making installation of the type to which he had reference are largely dictated by bin size, the speaker stated. A 60-ton bin setup would require floor space of approximately 14 feet by 36 feet. He pointed out that underneath a bin of that size there should be placed sufficient compressor and condenser capacity for a 64-ton plant. This adds up, he said, to a unit space requirement of approximately 8 square feet per ton of ice making capacity, as compared to about 50 square feet per ton in a conventional can ice plant of about the same size. He emphasized, too, that due to the lack of handling of directly made crushed or plate ice, sanitation of the ice is more readily controlled and less costly.

Kohlenberger presented a breakdown of the total cost of manufacturing crushed ice based on a 32-ton capacity plant having a first cost of $2380/ton.

Annual amortization, taxes, insurance. interest (15 percent) = $375/ton year = $357/312 days 1 year, $1.145/ton	
Water 32 tons x gallons x 2000 pounds .10 / 8.33 lbs. day ton 1000 gallons = $.768/32 = $ .030	
(Including evaporative condenser)	
Power 90 hp. compressor plus auxiliaries	
110 kw x 24 = 2640 kwhr — $.015/kw ÷ 32 =	$1.238
Maintenance and Operation Labor 3/32	.094
Materials Estimated (Maintenance)	.200
TOTAL COST/TON	$2.707

How Does Maintenance Get Material or Let A Contract

»» "THE Place of the Maintenance Function in Purchasing", was the title of an address given by Philip G. Damm, chief engineer of Merck Sharp & Dohme division, Merck & Co. Inc., at the Plant Maintenance & Engineering Conference in January this year.

Mr. Damm explained that his company has two plants and 75 maintenance mechanics. They spend about $200,000 per year on maintenance supplies.

In answer to the question, How do we go about getting material or letting a contract, Mr. Damm stated:

"In general, the Maintenance Supervisor writes an order on a numbered requisition. This requisition is in two copies. One copy goes to Purchasing and the other goes into Maintenance file for record. The requisition contains a place for a job order number which, when filled in, indicates where charges are to be placed. A complete description of the item requested is included on the requisition. The Purchasing Department upon receipt of the requisition prepares a Purchase Order to be sent to the Supplier. A copy of the Purchase Order goes to Maintenance and to our Accounts Payable Section where it is picked up on an I.B.M. Machine and the charge placed against a job order number. In this way we have a continuous record of charges on a particular job.

"Our practice in Maintenance when ordering equipment or outside contract work is to specify as completely as possible the item desired. In some cases we will go as far as naming a manufacturer, particularly, if we have standardized on that item. We also write complete specifications for certain contract work if job is complicated enough to require specifications. The Purchasing Department will then issue a purchase order and may even prepare a contract for certain requested work.

"There are many instances where we specify operating conditions and depend on our Purchasing Department to go out for prices and order the equipment.

"We have a rather envious relationship with Purchasing in that we have a Purchasing Engineer who was formerly a Plant Engineer. He knows many of our problems and the technical aspects of them. This makes for better mutual understanding. We also have a Buyer who concentrates on the purchase of maintenance items."

● With a refrigerator full of valuable produce, frozen foods and dairy-cooler items, you can't afford to take chances. That's why the management of Roundy's Better Foods, Milwaukee wholesale food merchants, approached the refrigeration problem of their new perishable food warehouse with a completely open mind.

● From the very beginning, the Roundy people and their architect, Charles Nagel and Associates, decided they wanted a refrigeration installation second to none—one that would meet all demands placed upon it—a flexible, dependable, efficient system with built-in safety and "insurance" features. Their selection was Vilter.

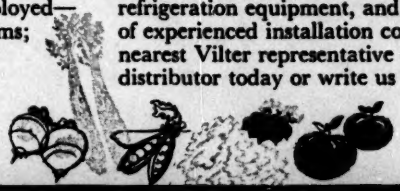
● The installation is a two-stage, Refrigerant-22 direct expansion system. All compressors are Vilter VMCs, for both the second stage and booster stage. Three refrigeration systems are employed—a special system for the banana rooms; a high temperature system for the general assembly, poultry, dairy and produce rooms; and a low temperature system for holding frozen fruits and vegetables, sea food, packaged meats and specialties. The latter two combine to form the two-stage system. The units are cross-connected for emergency service.

● The engine room is located next to the office. Smooth running Vilter compressors transmit no noise or vibration to any part of the building.

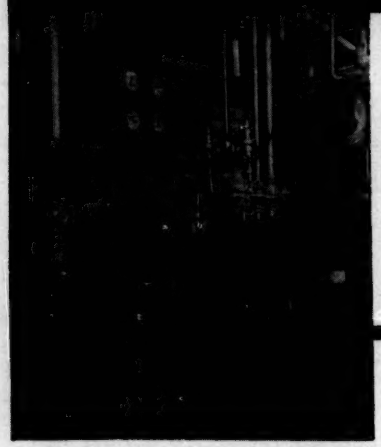
● All concerned have expressed complete satisfaction with the performance of the Vilter installation.

● Vilter VMC compressors deliver an excellent return for each refrigeration dollar invested—more capacity in less space; smooth running, reliable performance; easy-to-service design; built-in automatic capacity reduction.

● If you, too, want proven operation and efficient performance in your refrigeration equipment, and the benefit of experienced installation counsel, see your nearest Vilter representative or distributor today or write us directly.



HOW TO COLD



• Another view of the Roundy engine room. The vessel in the foreground is the refrigerant receiver while the vertical vessel in the background is an intercooler which increases the overall efficiency of the installation. The gauge board provides the operating engineer with a convenient means of checking the system's operation.

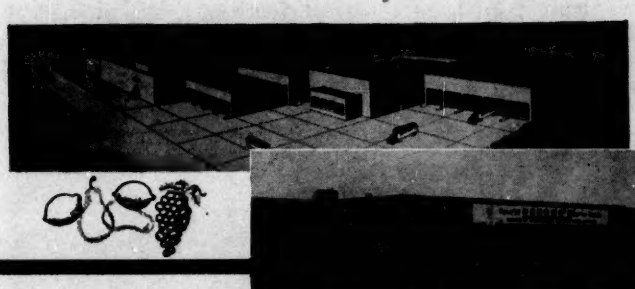
• In the produce room shown at right, and in the general assembly room, dairy cooler, and meat cooler, 5400 lineal feet of Vilter Zer-O-Disc fin coils are used. The entire system employs automatic hot gas defrost and is so arranged that not one degree temperature is lost during defrost periods. This is possible because of an ample number of coil circuits.

Correct temperature and humidity are maintained in these four rooms because the Vilter Zer-O-Disc finned cooling coils produce slow, even, positive air circulation naturally by convection.

• In the frozen food storage room handled by the low-temperature refrigeration system, large-size air units are used. The correctly sized duct work and anemostats produce outstanding results for proper air distribution. Room temperature does not vary one degree.

In each of the six banana rooms (not shown) are individual Vilter air units with both cooling and heating coils. Due to the occasional use of ethylene gas in the banana ripening process, explosion-proof motors and controls are employed.

PROTECT
$300,000 OF PERISHABLE FOODS



• This view of the engine room in the perishable storage unit of the new warehouse shows the five Vilter VMC compressors employed in the two-stage direct expansion Refrigerant-22 system: an 8-cylinder booster; two 2-cylinder and two 8-cylinder high stage units. Use of Refrigerant-22 has resulted in good efficiency and economy of operation.

The proper design, painstaking fabrication and careful assembly of Vilter compressors produce dependable units good for years and years of day-in-day-out operation. Vilter units are thoroughly factory-tested and run-in for immediate on-job operation.

• Here is the new home of Roundy's Better Foods in Milwaukee. It is one of the largest in Wisconsin and one of the finest wholesale food warehouses in the U.S. It supplies 350 member stores doing over $146,000,000 of retail business yearly. Lower view shows the latest addition; a perishable storage area containing 62,000 square feet of refrigerated space. There are separate cold storage rooms for produce; dairy products; meat; poultry; bananas; frozen sea food, meats, vegetables, fruit; and general assembly and storage. $300,000 of perishable foods is held here during peak periods. To protect this investment, reliable Vilter refrigeration is used throughout. Note the Vilter evaporative-condenser on the roof.

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Milwaukee 7, Wisconsin

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This view of the dock at Jerseymaid's new distribution center shows how portable chutes and telescopic conveyors are used in loading trucks. Note the conveyor belt in upper right corner of the photo.

Stacking irons, used as illustrated here, permit the maximal usage of space in the refrigerated storage area of Jerseymaid's distribution center by making it possible to stack incoming merchandise four pallets high.

By THOMAS A. DICKINSON

750,000 Foot Automated

»» A SUBZERO distribution center, believed to be the most fully automated facility of its kind in the world today, was recently placed in operation by Jerseymaid Milk Products Co., Los Angeles.

Leased from Union Ice Co., whose next door plant provides pipeline refrigeration for the structure, it was specifically built to replace an older warehouse which Jerseymaid occupied for nine years.

Its 750,000 cu. ft. of subzero space includes all of the room the company now requires to store enough food products to meet the needs of its retail outlets for a period of two or three months without replenishment, in addition to an order-filling system which occupies about a third of the area.

Non-refrigerated portions of the center include a dispatch office, driver office space, locker rooms, a dock for incoming and outgoing trucks, etc.

The dock is unusual in that it has connections which permit the refrigeration of trailers with ammonia-filled plates as well as with butane-operated transicold units.

Among other innovations are six view windows, each comprising three layers of Thermopane, which make it possible for supervisory personnel to observe work being done in the refrigerated area without exposing themselves to subzero temperatures.

At the receiving end of the dock, which is large enough to accommodate fourteen 40-ft. trailers, merchandise comes in on evenly-loaded pallets—thanks to a controlled ordering system, which makes it

This picture shows how cartons from 120 automatic flow lines are discharged onto four automatic belt conveyors in Jerseymaid's distribution center.

Two reciprocating gravity surge conveyors take accumulated cases to chutes for waiting delivery trucks as shown here in Jerseymaid's distribution center.

Six view windows like this one allow supervisory personnel to observe work being done in the refrigerated portion of Jerseymaid's new distribution center without exposing themselves to subzero temperatures.

Conveyors successively or progressively converge into one line, as illustrated here, prior to feeding merchandise onto one of two reciprocating gravity surge conveyors in Jerseymaid's new distribution center.

Refrigerator Handles Food Products

unnecessary to keep a large number of partly-loaded pallets in the storage area.

Some merchandise is also received at the rear of the building, where a spur track provides room for eight railroad box cars.

In the subzero storage area, stacking irons are used in order to assure the maximal use of space. Since each pallet carries about 85 cases and has a standardized height of five feet, each stack is normally four pallets high.

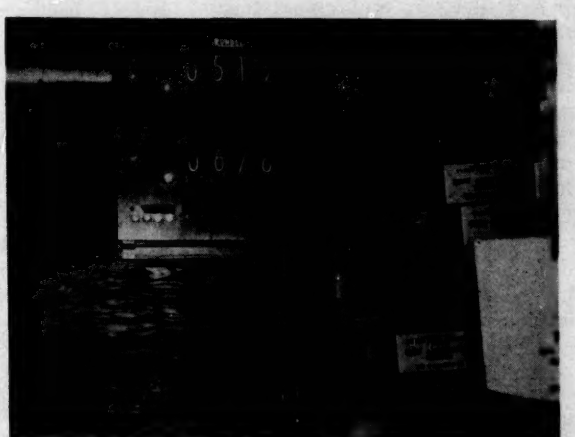
Temperatures maintained by Union Ice Co. in both storage and order-filling areas are continually within the −5° to −10°F. range.

Merchandise is transferred from the storage area to automatic lines in the order-filling area by means of special fork lifts. The latter place loaded pallets on rollers, which make it possible for a stocker to move any specified type of merchandise to a desired location.

Since Jerseymaid stocks more than 350 different food products which must individually and collectively be delivered in quantities ranging from one to several hundred cases, an unusual surge-accumulation conveyor setup is used to assure the fast and efficient transfer of ordered merchandise in proper route delivery sequence to refrigerated delivery trucks. This system was specially designed and made for Jerseymaid by Mathews Conveyor Company, and it has a number of features whose advantages should justify their extensive usage in warehouses of the future.

The surge accumulation feature of the system is such that merchan-

Automatic flow is regulated by two I.B.M. card readers and control panel. Manual release buttons are for special orders.



Signal panel tells manual picker the order number being filled and the next order to be filled in Jerseymaid's new distribution center.

dise is released from 120 automatic flow lines and discharged to four collecting belt conveyors which converge into two lines. The latter lines are, in turn, combined at a final converger where a manual selection discharge belt joins the automatic system items—after which an automatically controlled diverter directs each order to one of two reciprocating gravity surge conveyors.

Because they can accumulate as many as 600 cases at a time, the surge conveyors permit the simultaneous loading of two or more trucks. During the loading process, metering belts regulate the flow to overhead dock conveyor belts and a photocell-counting mechanism prints the total number of cases for each order.

The flow of merchandise to truck loading stations on the dock is controlled by diverters, and trucks are subsequently loaded by means of portable chutes and telescopic conveyors.

To make sure all orders will be properly refrigerated until they reach their destination, truck drivers are expected to make daily use of thermometers in their respective racks.

In making deliveries, drivers receive orders which they bring back to the distribution center each day. After being checked by route supervisors to make sure they have the right routing and customer order numbers, these orders (which are on standardized forms) are sent to an I.B.M. electronic data processing station. There, key punch operators transfer order data to commodity cards so that the information can be transmitted by a card reader to four separate memory units. Then relays can control the solenoid-actuated escapements which regulate the release of cases from the aforementioned automatic flow lines.

Simultaneous output from four different levels is also provided for by the memory units, and built-in sequencing control minimizes the possibility of case nterference on collecting conveyors.

In the event of a failure of either mechanical equipment or controls to function properly, operations are automatically halted in order to prevent any unnecessary damage to order-filling equipment; and at this writing it is not always possible for operating personnel to tell whether stoppages are due to non-usage or the malfunctioning of equipment components without making visual inspections. To eliminate the latter inconvenience, Jerseymaid officials are currently contemplating the feasibility of installing a closed-circuit television system which will permit the complete inspection of automated handling facilities whenever necessary by a man in the dispatch office.

By leasing a Union Ice warehouse for the distribution center, Jerseymaid has not only been able to avoid a substantial capital investment; it has obtained reliable refrigeration without taking on related maintenance problems.

This Skating Rink Piped to Eliminate Soft Spots

»»» SKATERS on Cleveland's two new outdoor ice rinks won't have to worry about part of the surface being made slushy by the sun's rays while the remainder is frozen solid.

A system that permits directing brine flow to compensate for spot melting has been incorporated in Cleveland's new rinks at Woodland Hills Park in the southeastern area of the city and Halloran Park in the southwestern area.

The new recreational facilities provide two outdoor rinks, each having a refrigerated skating area of 185 feet by 85 feet. The refrigeration system can maintain hard skating surfaces when atmospheric temperatures are considerably above the freezing point.

For the two rinks, Smylie Brothers Refrigeration, Inc., Cleveland contractors, used 100,000 feet of one-inch Jal-Con-Weld pipe purchased from Clark Goodman Supply Co., and manufactured by Jones & Laughlin Steel Corporation. Pipe is installed in 180-foot lengths between headers and mounted on T-bars spaced approximately eight feet apart having slots with four inch centers. These lengths were prefabricated by welding together 40-foot lengths of J&L Jal-Con-Weld.

Pipe ends were welded onto 85-foot-long, 3-1/2-inch headers at both ends of the rink area. The system works on the uniflow principle. To provide an even ice temperature, the rink is divided into four zones of 64 pipes each in which the brine flows alternately in opposite directions. A special reversing valve also permits directing more brine flow to any area that may be melting faster due to variation in the sun's rays.

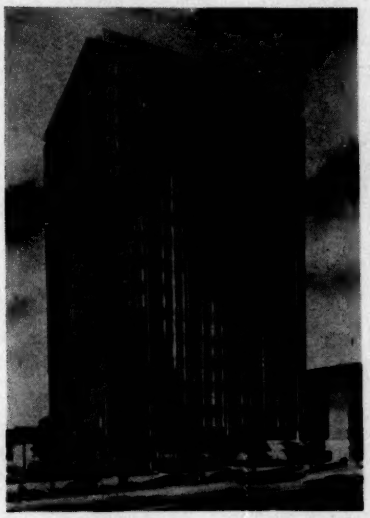
The piping system was covered with concrete-reinforcing steel matting and embedded in concrete to retain water and provide a smooth floor for the ice surface. The concrete rests on gravel over a clay foundation.

Supply and return lines for the calcium chloride brine are six-inch seamless steel pipe. Pumps can supply up to 1,000 gallons per minute of corrosion inhibited brine to the piping in the skating area. Refrigeration equipment for each ice rink

consists of one unit with two 75-ton Refrigerant compressors built on a special frame in the Smylie Brothers plant.

Multizone Units Condition Headquarters Of Signal Oil & Gas

»» MULTIZONE and air handling units manufactured by Recold Corporation will provide the air conditioning for the new world headquarters of Signal Oil and Gas Company in downtown Los Angeles, California. The modern 16-story office structure is being built at a cost in excess of $5,000,000 and will be ready for occupancy in mid-1960.

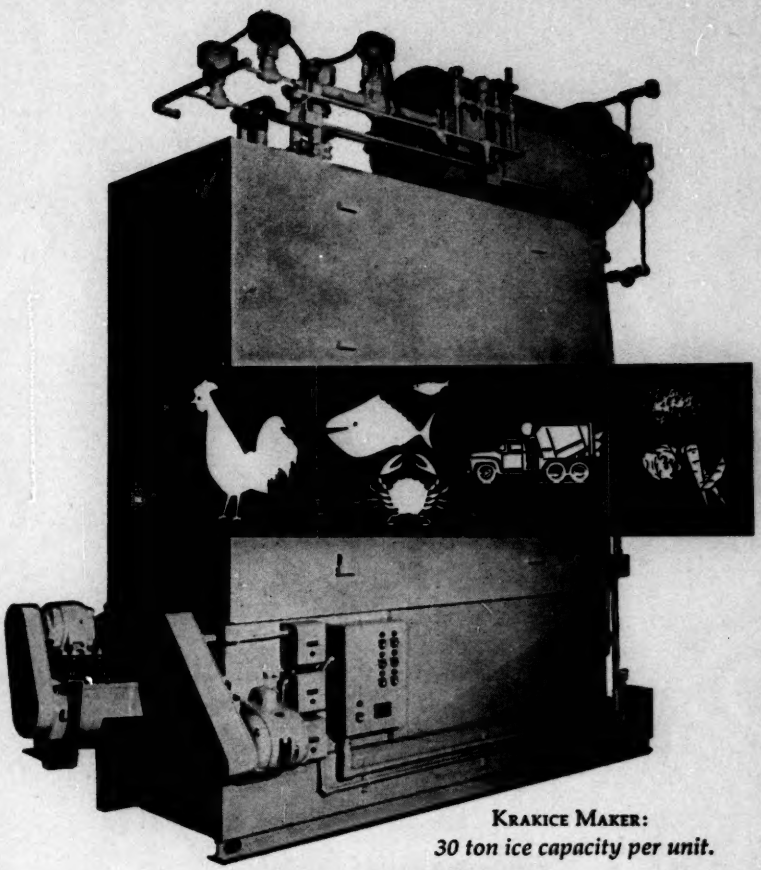


The air conditioning system was designed to provide a maximum 17° temperature differential between the inside and outside air. The executive offices for the building, located on the sixteenth floor, utilize a completely separate air conditioning system, calling for a full 20° temperature differential.

The multizone unit servicing the executive floor utilizes Refrigerant-12, while the rest of the building is installed with a chilled water system. Multizone Units are also placed on the mezzanine, and each odd-numbered floor up to the fifteenth story.

Three air handling units were chosen to pull fresh air into the building. The air supply to the building is filtered by activated charcoal, eliminating 85% of the impurities from the outside air.

The air conditioning was designed and installed by the Western Air and Refrigeration Company of Los Angeles, under the supervision of C. L. Peck, the contractor. Charles Luckman and Associates were the architects.



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Operation, Service and Maintenance of

Evaporative Coolers

»» AN evaporative cooler is basically a very simple device. The essential components of an evaporative cooler are:

1. A porous surface through which air can be drawn.
2. A system to keep the surface wet.
3. A fan or blower to draw air through the wetted surface and deliver the air to the space being cooled.

Being such a simple device, the problems of operation, service and maintenance are also quite simple. Very little time is required to properly train a man for cooler servicing and maintenance.

This talk will be aimed primarily at the drip type evaporative cooler since this is the type with which I am most familiar. Many of the points covered will, however, also apply to the spray type and rotary pad type of coolers.

Before getting into the subject of operation and service, I would like to make some suggestions regarding installation of evaporative coolers. By following good practice in the installation of the cooler and its air distribution system, better operating results can be obtained. One of the most important points to remember when designing the system is to maintain relatively high outlet velocities at the supply grille. The face velocities should be in the range of 1000 to 1500 FPM. The high grille velocity produces a good air movement in the room which can lower the effective temperature three to four degrees. For best results, at least one outlet grille should be located in each room to be cooled in order to provide proper air velocity in the room.

Another important rule with evaporative cooling is to supply 100% fresh air to the cooler. No recirculated air should be used. The cooler should be located away from sources of dust or objectionable fumes.

Where the cooler is to be mounted on the side of a building, it is preferable to locate the cooler on the side with the prevailing wind.

In wiring the cooler, a disconnect should be provided at or near the cooler so that the cooler can be serviced without danger to maintenance men.

It has been my experience that many service calls can be eliminated by properly checking a unit at a time installation is completed. The following is a suggested Start-up Procedure" for a typical drip type cooler.

1. With pad frames removed and water shut off, do the following:
   a. Run motor and check that blower wheel is running in correct rotation.
   b. If cooler is to be used with a duct system having over 1/8" wc. static resistance, the blower rpm should be checked and compared with the manufacturer's recommended rpm for the cfm and static pressure required. If necessary, adjust the variable pitch motor pulley to give the required blower speed.
   c. Check pulleys for alignment and adjust belt for proper tension.
   d. Clean loose fibers etc., from cooler bottom.
   e. Tighten any bolts which may have come loose in transit. Check blower shaft for end play and adjust thrust collars if necessary.
   f. Lubricate motor and blower bearings.
2. Next, turn on the water supply and do the following:
   a. Adjust the float valve to provide the recommended water level.
   b. On models having troughs attached to the cooler cabinet, turn on pump and check water flow from troughs. Adjust leveling of troughs to provide even flow. (Note: When checking water flow from troughs, blower should not be running as it might pull in water. Blower operation can be stopped by disconnect switch or removal of belt.)

      On models having the trough integral with the pad frames, the flow from the troughs is checked with the pad frame in place. Some models provide no trough level adjustment, depending on the use of short troughs to give even flow.
   c. Adjust water flow. Excess water flow from the pump, causing overflow of the troughs, can cause serious service trouble. The hose clamp should be adjusted to give a steady stream of water from each of the trough holes, but not enough to cause a possible overflow of the trough.
3. Next, install the pad frames and do the following:
   a. Check amperage of blower motor and compare with name plate amps. A clamp on ammeter is very convenient for this purpose. On some installations, the only convenient place to measure the

By RICHARD J. PETERSEN and ROBERT E. ABBOTT

This paper was a presentation at the U.S.A.F. Refrigeration and Air Conditioning Equipment Conference held at Wright-Patterson Air Force Base.

motor amperage is at the motor. In this case, it will be necessary to remove one of the pad frames in order to get to the motor. With the pad frame removed, the motor amp draw will increase somewhat because of the reduced static pressure imposed on the blower. Allowance should be made for this when determining whether or not the motor is overloaded.

b. Check that the pads fill the pad frames and that there are no void spots. It is especially important that the pads extend well above the bottom of the drip trough. Void spots in the pads not only result in reduced evaporative efficiency, but may also cause water droplets to be pulled into the blower. (Note: Some manufacturers are now using pads made of compressed aspen fibers. These pads appear very thin until they are wetted. Once the pad is soaked, it expands to 2 or 3 times its original thickness and retains the increased thickness.)

Now that we have covered the "Start-up Procedure," the next item to consider is that of operation of the cooler.

Probably the most important point to consider in the operation of an evaporative cooler is providing for adequate air exhaust. Since the cooler draws in all fresh air, the cfm delivery of the cooler is limited by the amount of air that can be exhausted from the cooled space. A minimum of one square foot of exhaust area should be provided for each 1000 cfm of capacity. The normal practice is to use windows for exhausting air from the cooled space. Where there is a prevailing wind, best results are obtained by partially opening windows on the leeward side of the building. Open windows can be used on the windward side, provided the total exhaust area is small enough so that warm air does not blow in through the windows. In some installations, it may be preferable to exhaust the air out through the attic space. This has the advantage of reducing the temperature of the attic area and thereby reducing the heat transmission into the occupied space.

The next point to consider regarding operation of the cooler is the matter of control. Most coolers in residential and commercial use are controlled manually, that is, they are turned on by the occupant when cooling is needed and turned off when the outdoor temperature has dropped to the point where cooling is no longer required. The use of two speed motors will allow better control in that the cooler can be operated on low speed when only a small amount of cooling is needed and on high speed when maximum cooling is desired.

Thermostats may be used with evaporative cooler systems; however, they should function primarily to turn the unit on at a preset temperature and to turn the unit off at the end of the day when the outdoor air temperature has cooled to the point at which cooling is no longer needed.

Humidistats are sometimes used

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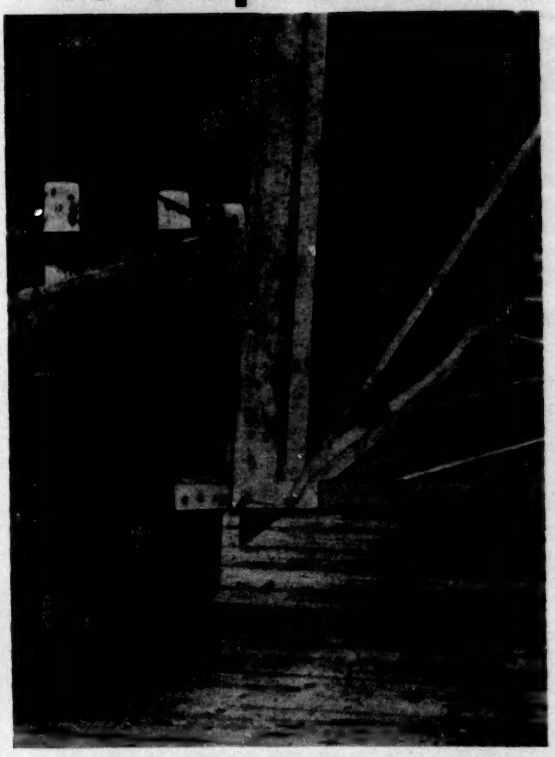

Angle iron in this picture was treated with Z.R.C. Heavy steel base was not —here's the result after several months at sea. "Z.R.C. is by far the best coating we have used for rust and corrosion control"—OCEANOGRAPHIC INSTITUTE, WOOD'S HOLE, MASS.

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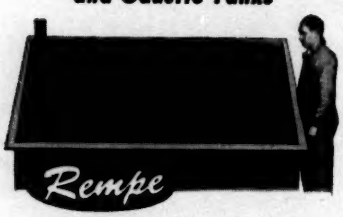

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with evaporative cooling systems to serve as a high humidity limit. When used in this manner, the control is placed in the electrical circuit to the water pump and serves to shut off the pump when the humidity exceeds a pre-set level.

Preventive maintenance should be done during the period when cooling is not normally required. By doing a thorough job of preventive maintenance, emergency service calls during the hot season can be kept to a minimum. The first step is to put the cooler in standby condition after the cooling season has ended. I would suggest the following steps:

1. Drain off water from the cooler sump and flush out any dirt and salts that may have accumulated. Wire brush any spots where lime may have accumulated.
2. Remove old pads and install new ones. Be sure that pad fills the pad frame, that it reaches well above the bottom of the trough and that there are no void spots.
3. Clean water distribution systems including pump screens, and troughs.
4. Check V-belt and replace it if it shows signs of cracking or excessive wear.
5. In areas where high wind and dust are prevalent, it may be advisable to place a weather cover over the cooler. Canvas or plastic covers are available that can be wrapped around the cooler. Some manufacturers also have steel covers available that fit over the pad frames. These are more durable than the canvas or plastic covers.

With the cooler properly checked as above, it is a simple matter to put the cooler back in operation when the cooling season arrives. The following simplified start-up procedure is recommended:

1. Lubricate blower and motor.
2. Turn on water supply and adjust float valve if necessary.
3. Check that water distribution from troughs is uniform and adequate.

The cooler is now ready for operation and should not require routine maintenance until about the middle of the season. At that time, the pads should be changed and bearings lubricated.

There is one important point not covered so far in this paper. That is the matter of bleed-off or blow-down. In most areas where evaporative coolers are used, the water supply is quite "hard." When coolers are used with a recirculation system, as they usually are, the accumulation of salts and scale is a very serious problem. As the water in the cooler evaporates, the calcium and magnesium salts in the water become concentrated to the point of saturation. As this saturated solution is evaporated on the pad surface, the calcium and magnesium salts are deposited on the pad fibers as a "scale" which in time will almost completely plug up the pad. The best preventive for this problem is to bleed-off or blow-down a portion of the sump water. Some manufacturers of drip type coolers have bleed-offs available that allow a portion of the water from the pump to be discharged down a drain, the amount being controlled by a hose clamp or orifice. Another method sometimes used is to connect a drain line of 3/4" pipe to the cooler sump with a manual shut-off valve located at a convenient point in the line. Periodically, the water supply in the sump can be dumped by opening the valve. Some coolers are equipped with automatic timer controlled dump valves which are very effective.

The amount of water to be bled-off or dumped will vary with the hardness of the water. However, for average water conditions, the amount of water wasted should equal about 50% of the water evaporated. The amount of water evaporated can be computed from the formula:

G.P.H. = .00012 x cfm x Temp. Drop where
G.P.H. = Gallons per hour of water evaporated.
CFM = Air delivery of cooler.
Temp. Drop = Decrease of dry bulb temperature of air passing through the cooler.

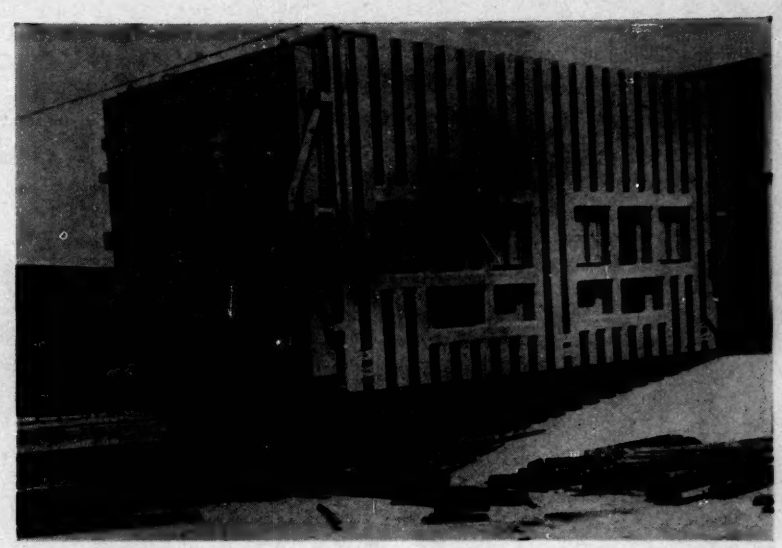
The use of a bleed-off or blow-down will greatly reduce service problems, and decrease the life of the cooler in most any area. Its importance cannot be over emphasized.

Test Chamber In One Package

ONE of the largest test chambers ever shipped overland in one piece was recently delivered by the American Research Corporation to a leading research and development firm in the space missile field.

This temperature-humidity-altitude chamber has a free test area of 10′ high x 10′ wide x 24′ long, and was completely pre-tested and shipped as one package, so that a minimum of installation was required.

The chamber has a temperature range of from −100°F to +350°F and will simulate altitudes up to 150,000 feet. It is completely automatic in operation, including push button control of the large doors which provide access for the test items.



Centrifugals

Continued from page 11

very smoothly with a vibration of one mil or less. It is for this reason that the machine can be installed on upper floors in a building and requires no more than the most elementary isolation, which is furnished as a standard part of the machine.

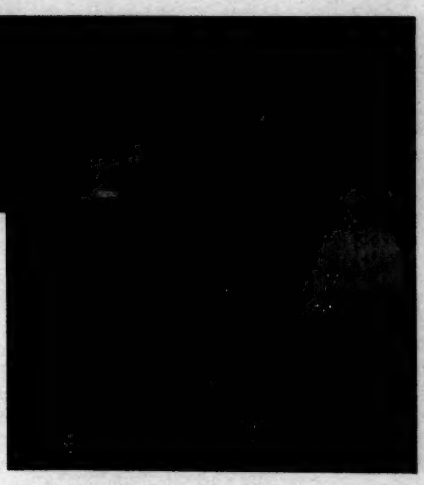
The impeller is a radial blade impeller cast from aluminum alloy so that it is light in weight and high in strength. We will discuss the impellers just a little later.

The impeller housings are of the volute type with a vaneless diffuser between the outlet of the impeller and the volute. This is a parallel side wall diffuser, the surfaces of which are machined smooth in manufacture so there is minimum turbulence at any gas flow. Since there are no vanes in the diffuser, the gas finds its own path under varying flow conditions, and the efficiency of conversion of velocity into static energy is very high.

Note the Venturi type shape of the vane housing assembly at the entrance to each stage of the impeller. At the inlet of the impeller and at the back of it are labyrinth seals which consist of a series of sharp points against the impeller in one case and the motor shaft in the other case. There is about .005 running clearance on a side, so there is no wear at this point, but gas bypassing is eliminated. When the machine is shut down, gas will seep past the shaft labyrinth so that the motor operates in a refrigerant atmosphere at all times, but there is no circulation of gas over this type of motor.

Looking at the oil sump you can see the two sight glasses, one of which shows the oil level and the other the pump motor rotation. There is also a thermometer which shows the temperature of the oil at all times. It is controlled to a constant temperature range both when the machine is idle and when it is running. The temperature range is 120 to 140°. This assures uniform quality of lubrication and

THE ULTIMATE IN THE COMPRESSION REFRIGERATION CYCLE*



THIS IS ANOTHER CYCLE CENTER, factory assembled and on its way to a 150 ton poultry freezing plant.

What will it do?*

It will provide liquid overfeed to the evaporators, catch the excess liquid and recirculate it to the evaporators, with these results:

- FULL COMPRESSOR PROTECTION AGAINST SLUGS
- PEAK COIL AND COMPRESSOR EFFICIENCIES
- SUB COOLED LIQUID FEED AT CONSTANT PRESSURE THE YEAR AROUND
- PRACTICALLY UNLIMITED RATE OF LIQUID FEED AT ABSOLUTELY NO POWER COST
- NO MECHANICAL PUMPS
- NO FLASH GAS IN LIQUID LINES
- SAFE, AUTOMATIC PLANT OPERATION
- OIL SEPARATION, ANY REFRIGERANT
- HIGHER SUCTION PRESSURES
- LARGE POWER SAVINGS
- LARGE SAVINGS IN FIRST COST ON NEW PLANTS. FOR EXAMPLE, THE RECEIVER IS NOT REQUIRED AND SURGE DRUMS ARE ELIMINATED.
- AUTOMATIC HOT GAS DEFROSTING AT MINIMUM COST

ASK FOR BULLETIN CC-2

* NOT JUST A LIQUID RETURN UNIT. Available for any refrigerant, in capacities from 10 to 1,000 tons and more. Factory assembly is optional.

J. E. Watkins Co.
3011 OAKLEAKE STREET MAYWOOD ILLINOIS

also prevents refrigerant from going into solution in the oil, particularly during shutdown, and causing nuisance cutouts on start-up due to foaming. In the oil line from the oil pump to the bearing is first a pressure relief valve so that oil is delivered to the bearings at a constant pressure as well as at a constant temperature, and then the oil filter which insures that the oil fed to the bearings is clean. These points contribute a great deal to the extended bearing life.

Continued Next Month

Frozen Food Packer Exposition Plans Set

THE 19th Annual Frozen Food Exposition of Supplies and Equipment, held in conjunction with the National Association of Frozen Food Packers' Convention, promises to be the largest and best attended Exposition ever staged by the Association, it was reported by Crawford Pollock, Director of Marketing of Campbell Soup Co. and Chairman of the NAFFP Convention Committee. At the beginning of January, with more than two months to go before the opening of the Convention-Exposition, reserved space more than equals last year and an additional 12 new exhibitors are already scheduled to participate. The NAFFP Convention-Exposition will be held March 6-10, 1960 at the Conrad Hilton Hotel in Chicago, Illinois.

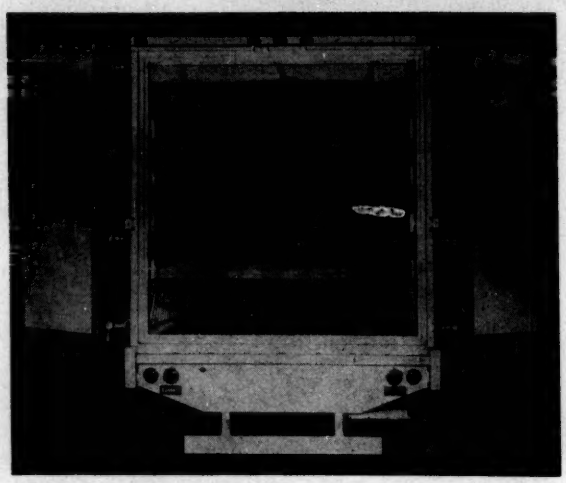
The hours for exhibit this year have been changed slightly. The Exposition will formally open Monday, March 7 from 10:00 am to 12:00 noon and again from 2:00 pm to 6:00 pm. Tuesday, March 8, the exhibit will be open from 12:00 noon to 6:00 pm, and Wednesday, March 9, the hours will be 9:00 am to 3:00 pm.

For the first time, this year a formal opening of the Exposition will be held Sunday afternoon, March 6 when the Board of Directors and their invited guests will tour the exhibits directly following the Board of Directors meeting. The preview will be climaxed by an informal reception in the Exposition Hall.

Commenting on this new innovation, Chairman Pollock said, "This preview of the exhibits by the Board of Directors and their invited guests is being established to generate a greater liaison between the executives of frozen food packer companies and the suppliers of services and equipment. Convention time is a busy time for all concerned.

REFRIGERATED "PIGGY BACK" TRAILERS GO INTO SERVICE ON WABASH R R

Exterior of completed "Piggy Back" refrigerated truck trailer which the Wabash Railroad has put into service. This is one of the first such trailers designed for all types of refrigerated cargoes.



Completed interior of new "Piggy Back" refrigerated trailer built for the Wabash Railroad by ALF-Herman Body Company of St. Louis. This view shows extruded aluminum floor plate, meat rails and side wall construction.

»» ONE of the first "Piggy Back" trailers designed for safe and efficient transportation of all types of refrigerated cargoes has been put into service by the Wabash Railroad to serve the great Mid-West market.

Wabash has ordered 10 of the new trailers equipped with the latest Transicold system—a dual system operated by diesel fuel or electric standby—from ALF-Herman Body Company, St. Louis, Missouri.

The trailers are steel and corrugated aluminum construction. They measure 40 feet long, 8 feet wide, and 12-1/2 feet high. They are finished in polished aluminum and carry the Wabash insignias on sides and front.

Rear doors are full width and equipped with special refrigeration type hardware. Interior lining is marine plywood, special plastic sheeting and half-round chemically treated stripping. The floor is extruded aluminum specially designed with cross ventilation.

Temperature within the trailer can be regulated from a simple dial system, and adjusted from -20°F to 80°F, making it possible for the trailer to carry any type of load. For meat hauling, the roof of the trailer is equipped with full length meat rails.

High thermal efficiency was achieved by effective use of insulation and moisture barriers.

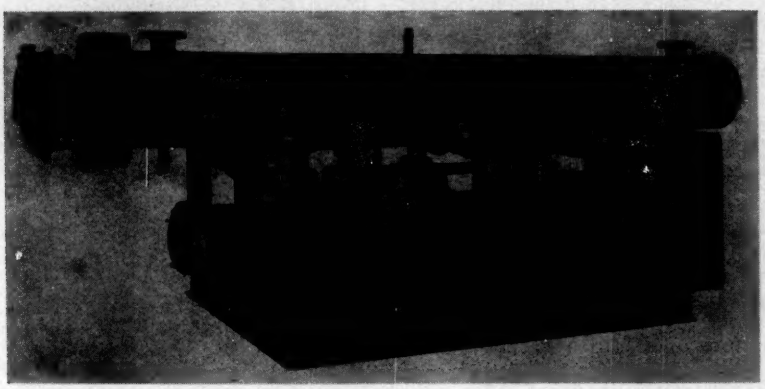
The trailer interior was first sprayed with a vapor barrier mastic. A layer of aluminum foil was applied to the mastic.

Armalite in two three-inch layers was applied to the floor. The second layer was laid in the opposite direction from the first to break all joints to be sure of no through conductance. Another layer of aluminum foil was applied to the top of the final layer of insulation and this was covered by an extruded aluminum floor.

Fiberglas was used in both the walls and roof which were constructed the same way as the floor. The walls used six inches of Fiberglas and the roof seven inches. The walls were finished with marine plywood faced with Fiberglas reinforced polyester. Stringers were then installed to allow circulation of air, keeping the product away from the flat wall surface. Meat rails were suspended from the ceiling. The doors also were insulated with Fiberglas.

New Products Designed to Improve Operation

Packaged Liquid Chiller With Direct Drive



AVAILABILITY of a completely new line of direct drive and semi-hermetic packaged liquid chillers is announced by Curtis Manufacturing Company.

Sizes represented in the new, compact chillers range from 75 through 125 hp. in direct drive compressors, and 7½ through 60 hp. in semi-hermetic compressors. All are designed for high-efficiency chilling of brines, glycol, oils, solvents, alcohol, kerosene, gasoline, drinking or processing water, and other liquids.

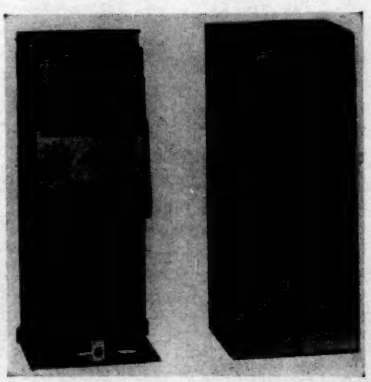
Like Curtis' regular line of open type reciprocating compressor units, these new packaged liquid chillers provide economical answers to an infinite variety of air conditioning, temperature and humidity control and process cooling applications. They are adapted for operation with all types of air handling equipment, whether central station, individual room, multi-zone, or remote type units.

All Curtis chillers feature matched components: multiple-cylinder compressor, water cooler shell and tube condenser, liquid chiller, all refrigerant piping, expansion valve, solenoid valve, operating and safety controls, refrigerant holding charge. Factory engineered and tested, they are shipped completely assembled. Field installation requires only control setting, adding refrigerant, and connection of water and electrical lines.

Temperature Controller

A NEW concept in temperature control instruments is now provided with the Model 8251-203 Unichannel on-off Thermistor temperature controller. All circuitry, with the exception of tubes and relay, is completely encapsulated in epoxy plastic providing the maximum in reliability and ruggedness for trouble free operation under conditions of shock and vibration. Because of the unique packaging, freedom from dust and moisture is insured.

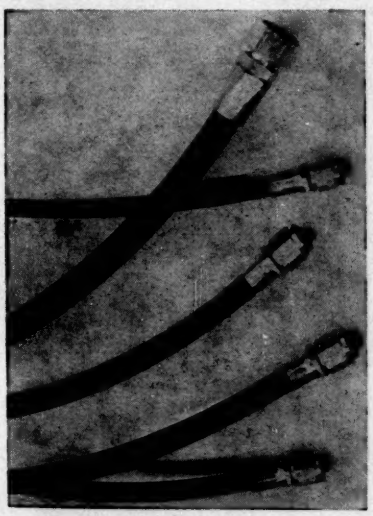
The Unichannel controllers are used on a wide variety of applications which require close temperature control at low cost. The Model 8251-203 is furnished with an anticipating section for closer control, and comes with a load relay rated at 25 amps,



230 volts. The small box is suitable for wall mounting, and the entire unit unmounts from the box for ease of wiring. Control stability of the Model 8251-203 unit has been achieved to ±1°F. Two standard temperature ranges of 200-600°F and 0-200°F are available. List price of the Model 8251-203 is $106.00, complete with anticipating section, thermistor sensing element, and load relay and enclosure.

Nylon Pressure Hose

HOSE with a specially formulated nylon inner tube reinforced with high tensile strength yarn is now available from The Polymer Corp. Known as Nylaflow pressure hose, it is one-fifth the weight and has a wall thickness less than one-half of rubber hose with equivalent burst strength. The hose has a newly developed abrasion resistant cover.



The new hose exhibits outstanding resistance to flex, pressure-pulse and vibrational fatigue. On flex-impulse testing, a Nylaflow hose with a rated maximum operating pressure of 1250 psi, when pressure pulsed to 2500 psi, flexed 1,171,000 times and withstood 96,000 impulse cycles without failure.

The hose is unaffected by flammable and non-flammable hydraulic fluids. It has low refrigerant permeability, approximately one-tenth that of rubber hose. While not recommended for use in mineral acids above 5% concentration, it has excellent resistance to caustics and almost all organic solvents. The hose is now being used for hot paint spray applications. It is non-toxic, non-cor-

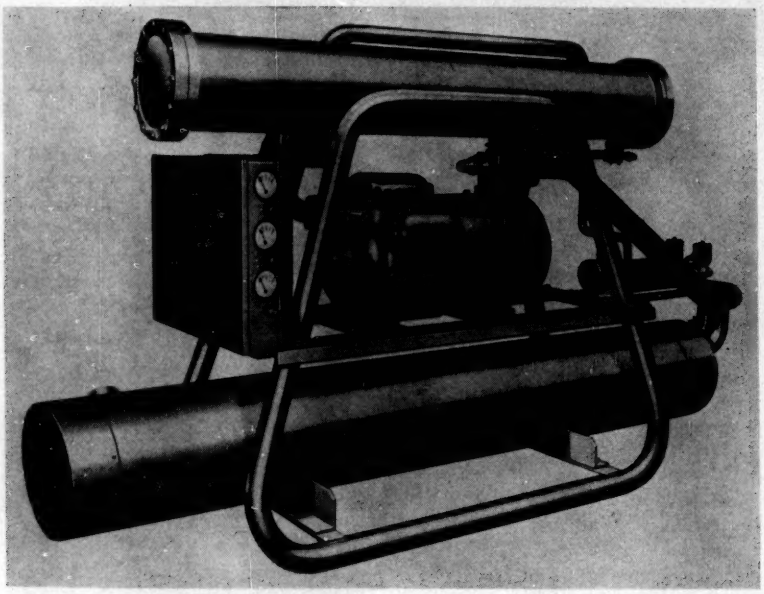
rosive, fungus resistant and will not embrittle in storage.

The hose retains excellent flexibility and toughness in temperatures as low as -65°F. It can operate constantly in temperatures up to 200°F. and intermittently in temperatures as high as 300°F.

Two types of hose are presently available with recommended maximum operating pressures of 1250 and 2000 psi (5000 and 8000 psi burst strengths respectively). Inside diameters are 1/8", 3/16", 1/4", 5/16", 3/8" and 1/2". Larger sizes are available upon request.

The new product is designed for improved hose performance in such applications as hydraulic, lubrication, fuel and oil, hot paint, solvent, water, refrigerant, and high pressure pneumatic and CO_2 lines.

Hermetic Reciprocating Chiller



THE Trane Company has redesigned its reciprocating cold generator with a newly developed hermetic reciprocating compressor as the heart of the unit.

The new units are available in 10 sizes, from 10 to 100 tons. All models are small enough to pass through a standard 36-inch wide commercial door.

The compressor, designed for Refrigerant-22 and Refrigerant-12, operates at 1,750 rpm. It has a volumetric efficiency of 85 percent at 40 F. suction and 105 F. condensing temperatures.

Multistep capacity control reduces starting and stopping of the compressor and reduces power requirements. A large suction separation chamber and safety head springs protect the valves and pistons from damage due to slugs of liquid refrigerant or oil. An enclosed force-feed oil system with filters, magnetic plugs and carefully located and proportioned oil passages, insure a supply of clean oil to all bearings.

Aluminum alloy pistons and connecting rods reduce vibration. A one-piece crankshaft, dynamically and statically balanced, is free of bolted-on counterweights. Plastic backstop cushions are used for the discharge valves to reduce metallic noises. Large area gas passages also minimize noise.

Automatic Oiler

WITH the rising cost of labor and a need for reducing maintenance cost on checking air compressor oil level, the S & G Manufacturing Corporation in New Orleans can now supply an automatic oiler for small air compressors used on air dryers and dehydrators.

The automatic oiler comes in kit form with directions for installing on small size air compressors.

Extensive tests have shown this unit to be dependable and capable of avoiding many air compressor failures due to low or no oil in the base. On most small air compressors that are found on the air dryer and dehydrators, the low oil level has to be checked often and oil has to be added from time to time.

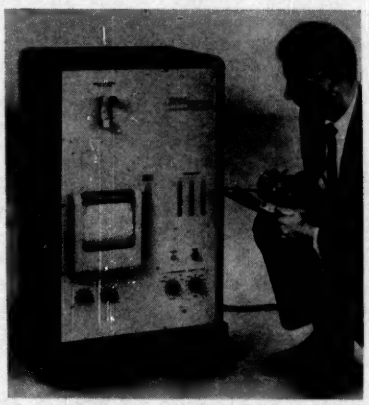
With the automatic oiler, inspection time can be saved as the oil level in the compressor base can be determined by sight without stopping

the compressor and the air compressor will be safe from throwing rods or burning up. The oil reservoir is visible and the level can be seen at all times indicating that oil is in the crankcase.

Complete information may be obtained from: S & G Manufacturing Corp., P. O. Box 1309, New Orleans 10, La.

Atmospheric-Particle Monitor

NEW atmospheric-particle counting instrument has been designed for application to the continuous monitoring of outdoor air or atmospheres of indoor locations, such as ultra-clean work areas. It presents, on a strip-chart recorder, a permanent record



of aerosols present in an overall range from 0.3 microns to any desired upper limit. This record is differentiated into 15 sub-ranges and recorded in sequence at intervals which can be predetermined in length. Stability problems are eliminated by the fact that the unit is continuously self-calibrated.

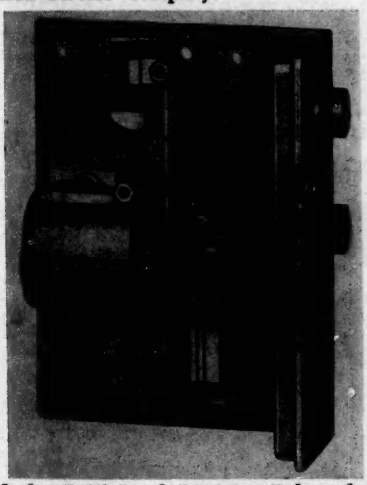
Included in the instrument is an

alarm system which can be set for a remote indication of particle concentrations in any of the monitored subranges exceeding a predetermined maximum.

Counting rate of the PC-200 is 1000 particles per minute with a 1 percent coincidence loss at the standard flow rate of 100 cc per minute. Recordings are made on a 6-in. strip chart at a standard movement of 8 in. per hour. Operation is from a 115-v 60-cps supply with a current of 3 amp.

Limit Control

A NEW limiting device, engineered to provide positive protection against motor overload and featuring an adjustable demand limiter, has been released by the Johnson Service Company.



Called the R-27 Load Limiting Relay, the device, which is designed for use with pneumatic control systems, is intended for application to all types of centrifugal refrigeration compressors. Installed in the pneumatic control circuit and responding to motor current, it limits the opening of the capacity regulating inlet valves or dampers to maintain a pre-determined maximum motor current regardless of the demands of other controllers. According to the manufacturer, the R-27 is especially valuable in preventing damage during the "start-up" period and following prolonged or over night shutdowns, the most common instances of overloading.

Highlight of the new relay is a remotely located manual adjuster for limiting the motor current to any selected value between 40 percent and a 100 percent of the maximum. It thus becomes a convenient "demand limiter," useful in reducing electric demand charges during periods of less than maximum load.

Designed to operate at any current between three and seven amperes, when used with a properly selected current transformer it can be applied to motors of any size. The secondary winding of the current transformer energizes the coil of the R-27 relay which in turn activates a conventional pneumatic relay to vary the output pressure in inverse proportion to the current. Maximum motor current is established by an integral set point adjustment. A supplementary winding on the relay coil, provides demand limiting.

Other common applications of the R-27 Relay include pumps, fans and electrical heating installations.

Electronic Air Cleaner

A NEW line of electronic air cleaners for installation in smaller industrial buildings was announced recently by the Electro-air Cleaner Company.

The company, which has been marketing a wide

GENUINE

OZITE®

STANDARD *ALL-HAIR*

PIPE COVERING

INSULATION

lasts a lifetime!

Genuine Ozite pipe covering insulation installs easily on curves, fittings, straight pipes or valves . . . stops wasteful heat absorption effectively and permanently. Ozite insulation also helps maintain uniform temperature and increase your equipment's refrigerating capacity. Try Genuine Ozite!

NO SHAPE IS TOO COMPLEX

A PRODUCT OF

AMERICAN HAIR & FELT COMPANY

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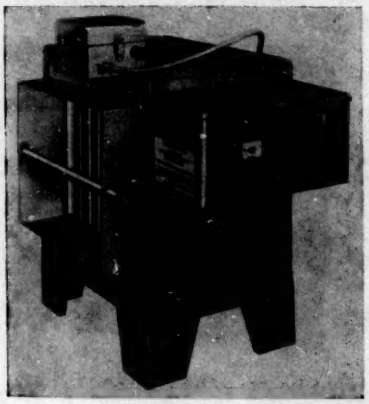
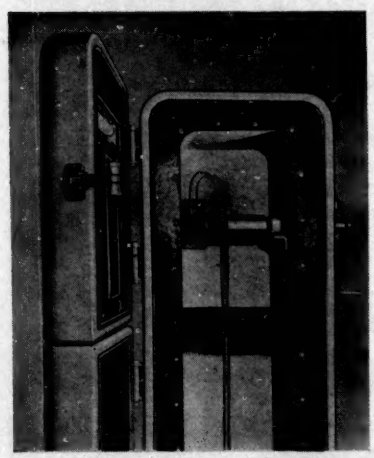
range of electronic air cleaners for a number of years, announced that the new units will be available in five models—one in the company's Universal line, and two each in the Tec line and Compact line.



The new units were made possible by reducing ionizing-collecting cell plate spacing to 5/16" and the application of other refinements in cell and power pack design. The resulting units require less space, have lower prices, but retain essentially the same design which has been successfully sued in Hi-C "High Capacity" commercial and industrial equipment produced by Electro-air.

The addition of the new models brings to 26 the number of models produced by Electro-air—both horizontal and vertical air flow, from 800 to 10,000 cfm capacity.

Cold Chambers For Wire Testing



A COMPLETE line of cold chambers especially designed for testing wire and insulation breakdown, in accordance with military specifications, is available from Cincinnati Sub Zero Products.

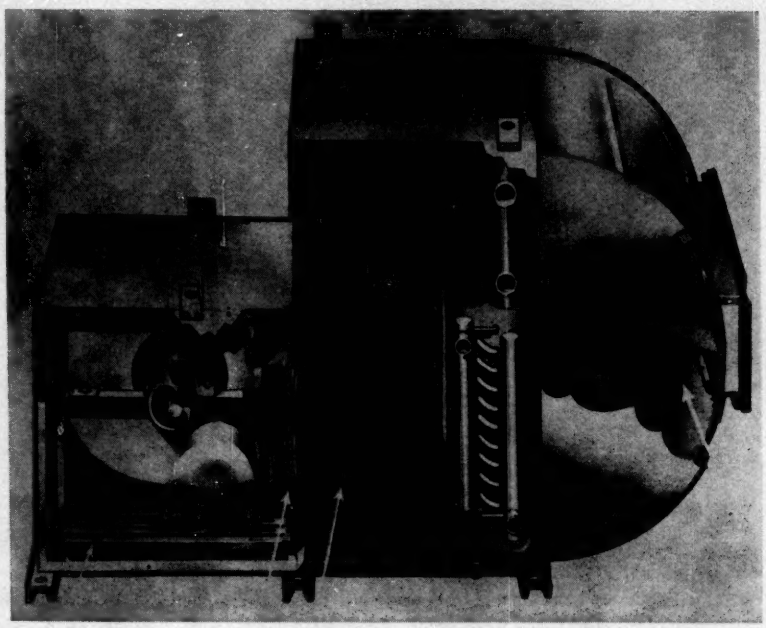
The chambers are constructed so that a mandrel can be installed in the upper part of the chamber. One end of the wire to be tested is suspended from the mandrel, with the other end hanging free. A specified weight is attached to the free end to exert a force on the wire.

By means of an outside control, the wire is wound on the mandrel without disturbing the test temperature. After winding, the sample is removed and examined for surface cracking and other flaws. This "cold bend" test is used for improving many types of commercial and military wire.

The one-piece cabinet is constructed of 16-gauge steel with a 10-gauge steel base for extra strength. Outside dimensions are 84" high, 20" wide and 42" deep. The testing chamber, constructed of 14-gauge galvanized steel, measures 12" x 12" x 72".

The chamber is lighted, has a Multipane frostproof window 6" wide x 12" high, and is available with or without a circulator to keep inside air recirculating at all times to prevent stratification of warm air. The unit operates on 230 Volts and has a temperature adjustment from -10 to -80°F. Thermal capacity is 200 Btu/hr at -70°F. Other capacities and temperature ranges are available.

High Velocity Air Moving Unit



DRAYER-HANSON'S new line of high-velocity air conditioning equipment for multi-storied applications is now offered in a broad range of 9 models (cfm 3500 to 27,000), for DX, cold water, hot water and steam, by the West Coast manufacturer.

The line engineered for hot and cold duct operation, at static pressures from 2-1/2" to 8", has been redesigned to incorporate numerous new sales factors such as addition of a plenum divider for ease of connecting ductwork on a double-duct system. Units are only two bearing system, even on two-fan types—which eliminates alignment problems on the fan. Bearings are life-time lubricated.

These redesigned, blow-thru type models, designated HCD, offer unlimited flexibility to planners, it is stated. The line, reintroduced as a lead item in Drayer's 1960 new product line-up, has been specifically designed, engineered and constructed for high pressure performance—it is not an adaptation of standard low-pressure air-handlers, as has been a practice with some manufacturers in the Industry. Purchasers are offered the option of horizontal or vertical discharge. Other features include, spring-mounted fan and motor assembly for internal vibration isolation; discharge plenum and baffle dividing hot and cold sections. Insulation is 1/2" fiber glass, covered with vinyl coating.

For ease of servicing, the unit carries three oversize access doors which permit full-entry examination and servicing. As an extra safety factor, doors on the pressure side open to inside of unit; panels are removable.

Industry Meetings

Symposium — **March 18, 19**
THE REFRIGERATION RESEARCH FOUNDATION
On Package Environment in Refrigerated Warehouses
LaSalle Hotel, Chicago

Power Forum — **Mar. 29-31**
ILLINOIS INSTITUTE OF TECHNOLOGY
22nd Annual American Power Conference
Hotel Sherman, Chicago

Dairy Supply — **March 31-April 1**
DAIRY INDUSTRY SUPPLY ASSOCIATION
41st Annual Meeting
Edgewater Beach Hotel, Chicago

Warehousemen — **April 25-28**
NATIONAL ASSOCIATION OF REFRIGERATED WAREHOUSES, INC.
American Hotel, Bal Harbour, Florida

Air Conditioning Conference — **Apr. 27-30**
WESTERN AIR CONDITIONING INDUSTRIES ASSN.
Shrine Exposition Hall, Los Angeles

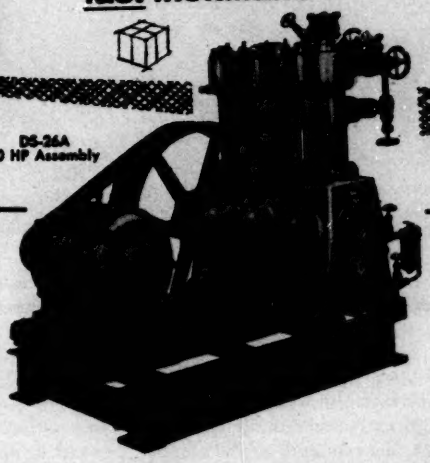
Meat Packing — **May 12-15**
NATIONAL INDEPENDENT MEAT PACKERS ASS'N.
Ambassador Hotel, Atlantic City

Air Conditioning and Refrigeration Institute — **May 1-4**
BOARD AND ANNUAL MEETING
The Homestead, Hot Springs, Va.

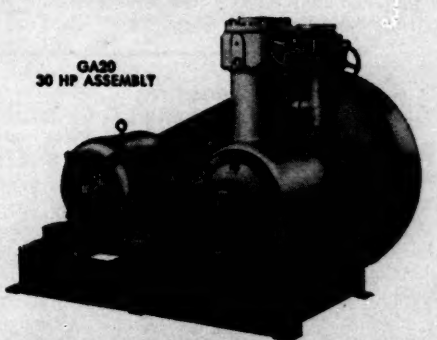
Cryogenics — **August 23, 24, 25**
CRYOGENIC ENGINEERING CONFERENCE
Sponsored by University of Colorado
And Bureau of Standards
Boulder, Colorado

Dairy Show — **Oct. 31 to Nov. 5**
22ND DAIRY INDUSTRIES EXPOSITION
With 8 Dairy Industry Organizations
Annual Meetings
International Amphitheatre, Chicago

HOWE
COMPRESSOR "PACKAGES" assure fast installation!



Factory-assembled with compressor, drive and motor on a steel base, HOWE'S compressor "package" can be completely installed in a matter of hours. In both standard and booster models with capacities to 60 H.P., these new HOWE assemblies sharply cut installation costs. They save time and space, and eliminate need for special foundations and expensive belt guards. World-famous Howe Compressor qualities, with medium speed and long life, are now built into complete, compact assemblies. The know-how gained from nearly fifty years of refrigeration equipment manufacturing assures maximum efficiency at the lowest possible cost. Consult Howe today!
Write for literature



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Film Strip "Building Weather" Available

Part of the test apparatus used by Armstrong Cork Company in its three-year research program into the problems involved in insulating air conditioning systems. Latest results from the study have been incorporated into a strip film titled "Building Weather".

»» LATEST results of a continuing study into the problems involved in insulating air conditioning systems have been incorporated into a sound, strip film titled "Building Weather" by the Armstrong Cork Company's Insulation Division.

The film is a non-commercial, technical presentation covering the development of normal inside design conditions along with a review of many of the problems involved in insulating air conditioning systems.

"Building Weather" is available to interested groups by contacting Department BW, Armstrong Cork Company, Lancaster, Pennsylvania. It runs approximately 16 minutes.

The film is based on the premise that outside weather data alone is not accurate for use in predicting inside ambient conditions. It further assumes that if we are able to reliably establish normal inside design criteria and can predict and/or eliminate those unusual conditions of excess severity, we can then more realistically and economically determine pipe insulation requirements.

The film lists the cause of moisture problems and gives a number of suggestions for eliminating or minimizing them.

The Armstrong Research and Development Center has been working extensively on this problem for more than three years. The project has not been completed but has gone far enough to justify a full progress report.

Disa's 41st annual Meeting Set For March 31-April 1

»» THE 41st Annual Meeting of Dairy Industries Supply Association will be held March 31-April 1 at the Edgewater Beach Hotel in Chicago. Major business before the annual gathering of the nation's dairy industrial suppliers and equippers will be plans for the staging of the forthcoming 22nd Dairy Industries Exposition, scheduled for Chicago's International Amphitheatre in the autumn (October 31-November 5).

Top-flight speakers from a number of fields also are scheduled to address the gathering. Robert Keith Gray, Secretary to the Cabinet of President Eisenhower, will be the featured speaker at the 41st Annual Banquet on March 31, on "Increased Business Participation in Political Activities."

DISA President D. G. Colony, Manton-Gaulin Manufacturing Company, Inc., will discuss the association's development during his two-year service in the top post and point to paths of possible future development.

Other speakers include Dr. Ralph G. Nichols, Head of the Communications Program, University of Minnesota, whose topic is "Are You Listening?"; Hunt Hamill, Krim-Ko Corporation, representing National Dairy Council and reviewing the state of the dairy industry's armament of "Nutritional Research" for market defense and market offense; and Donald H. Williams, DISA's Technical Director, looking ahead to "Dairy Industrial Technology of the 1960's."

A unique industrial lottery, which will decide the display locations of nearly 400 member companies in the forthcoming Dairy Industries Exposition, will also be a feature of the meeting. In foremost place by many measurements among the outstanding regularly held industrial shows of the world, the Exposition allots space to its exhibitors by a neutral lottery system which DISA developed many years ago and variants of which now are used also by managements of various other large industrial showings.

A bus trip to International Amphitheatre, which has never housed a Dairy Industries Exposition, will be a first item of the meeting agenda on the morning of March 31. The trip is offered optionally for executives and exhibit planners who may not be familiar with the Amphitheatre, the largest building ever to be used by the DISA-sponsored Show. Earlier stagings of the Exposition in Chicago have occupied the municipally operated Navy Pier.

Three At-Large Directors and four Commodity Directors are to be elected to fill one existing and six impending vacancies on the supplier-equipper eighteen-man governing body. The election will occur the evening of March 31; the new Board will sit the following morning and elect officers for the coming year. New officers will be introduced to the membership at a luncheon on Friday, April 1.

The meeting was planned by an Annual Meeting Committee headed by G. A. M. Anderson, the King Company, and served on by: T. O. Gaskins, Crest Foods Co., Inc.; J. E. Greb, G & H Products Corp.; Hunt Hamill, Krim-Ko Corporation; M. C. Pendleton, The King Zeero Company; and Mrs. L. S. Worthington, Kold-Hold Division of Tranter Manufacturing, Inc.

Arons Is Speaker At Sanitarian Meet

HUBERT M. Arons, vice president and general manager, Hartford Freezer Corporation, recently told the Connecticut Association of Dairy & Food Sanitarians how public refrigerated warehouses handle and store frozen foods.

Mr. Arons pointed out that the safe, scientific storage and handling of the great variety of frozen foods available today requires more than just good physical facilities. Specialized handling equipment, well

trained employees, a knowledge of perishable commodities, plus an acute sense of service and responsibility are also necessary, he said. He explained that the industry has, through long experience, developed various specialized procedures for the care of perishables which have come to be accepted as good practice and which every well operated refrigerated warehouse observes. The high quality of today's frozen foods is due in large part to the highly specialized care they receive from refrigerated warehousemen on their way from processor to the family table.

Mr. Arons made his remarks at the Sanitarians' 35th Annual meeting at Cheshire, Conn., where he participated in a panel on frozen foods.

Pennsalt Isotrons Make Ice For Olympic Skating Events

»» CONTESTANTS in the skating events at the eighth Olympic Winter Games at Squaw Valley, California were skating on ice made by Isotron refrigerants manufactured by Pennsalt Chemicals Corporation. Pennsalt's Isotron 12 was selected to help furnish the ice for the many racing and figure skating contests in the 109,000 square feet of skating rinks.

Olympic ice must be fast and smooth, and maintained at a constant temperature of 28° despite intense mountain sunshine. The highest standard of performance is required of all equipment and material used in the famous international event.

To help Isotron wholesalers to tie in with the Olympics, Pennsalt provided 250 selected wholesalers with a sales promotion package consisting of a colorful folder, easel-back counter card, window streamer and a reprint of an advertisement running concurrently in three leading trade publications.

Each of the promotion pieces featured the figure of a girl skater in picturesque Squaw Valley. The promotion material was sent to wholesalers a month in advance of the Winter Games.

Allied Chemical Changes Ammonia Brand Name

»» ALLIED Chemical Corporation has changed the brand name of its anhydrous ammonia from Barrett Brand to Allied Chemical Anhydrous Ammonia.

In announcing the change, a company official explained the designation "Barrett" originated with Allied Chemical's Barrett Division which first produced and sold the product. However, today Allied Chemical's Nitrogen Division produces and sells anhydrous ammonia. The Allied Chemical logotype recently received official recognition as a trademark of the company.

Anhydrous Ammonia was first produced commercially in 1890 in the U. S. by Allied Chemical. It was obtained as a by-product of the distillation of coal fom the country's first by-product coke ovens at Syracuse, New York. Working in laboratories at Laurel Hill, L. I., N. Y., a research organization which later became Nitrogen Division made great advances in ammonia synthesis. This resulted in 1918 in the production of the first synthetic ammonia in the U. S.

Allied Chemical Anhydrous Ammonia is stocked in 150, 100 and 50 lb. cylinders warehoused at many points located throughout the country. It is also available in tank truck, tank wagon, tank car and barge quantities from the division plants in Hopewell, Va., South Point, Ohio and Omaha, Nebraska.

The principal uses for Allied Chemical Anhydrous Ammonia are: metallurgy, as an economical source of hydrogen and nitrogen; refrigeration,

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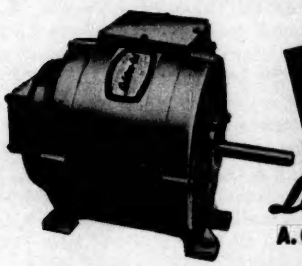

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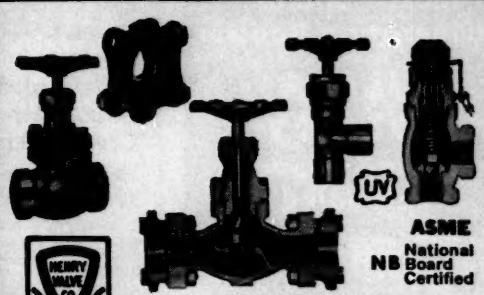

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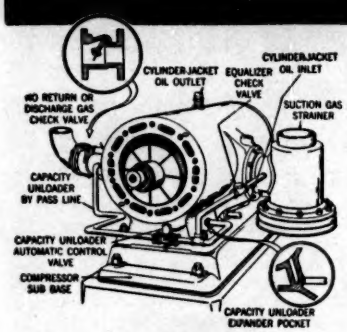
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Catalog Of Hose Fittings And Hose

››› A NEW eight page, two color, illustrated catalog of hose fittings and hose has been published by Lenz Company of Dayton, Ohio. Pictured and detailed with specification tables are reusable hose fittings, assemblies, adapters, and single and double wire braid hose. These components are designed for high, medium, and low pressures in universal industrial applications.

The catalog is divided into eight sections. Sections one through three are headed Single Wire Braid Hose Construction and Specifications; Single Wire Braid Hose Fittings; Single Wire Braid Medium Pressure Hose Assemblies. Sections four through six cover Double Wire Braid Hose Construction and Specifications; Double Wire Braid Hose Fittings; Double Wire Braid High Pressure Hose Assemblies. The final two sections detail Hose Adapters and Swivels; Single Wire Stripped Cover Hose and Fittings. Diagramed assembly instructions are included.

Copies may be obtained by writing Lenz Company, 3301 Klepinger Road, Dayton 1, Ohio.

Halstead & Mitchell Issues Air-Cooled Condenser Catalog

››› THE new Halstead & Mitchell air-cooled condenser catalog presents a thorough analysis of these devices from the twin standpoints of "specification" and "application." Four types of units are discussed in great detail —those using propeller fans for horizontal air flow, propeller fans for vertical air flow, centrifugal fans for use with duct-work, and centrifugal fans for residential air-conditioning.

This Bulletin AC-102 describes construction features, which include the company's exclusive Turbu-Flo design for its finned coils. "Turbu-Flo" is designed to provide more surface for better heat transfer. Coil and fan data is given in detail, as are capacities in Btu/hr. at the evaporator.

Sections of the catalog are devoted to operation of air-cooled condensers under winter conditions, in indoor use, and on residential and small commercial jobs. Typical specifications for air-cooled condensers are provided for consulting engineers and others who are concerned with proper selection of equipment.

Copy may be obtained by writing Halstead & Mitchell, Bessemer Building, Pittsburgh 22, Pennsylvania.

Coil Catalog Available

››› THE Young Radiator Company, Racine, Wisconsin announces release of a new coil catalog. It contains complete information on all water and direct expansion refrigerant coils. The 27-page, 2-color catalog includes water, direct expansion and booster coil specifications. Exclusive construction features are covered.

The completely new catalog includes selection of water heating and cooling coils, physical and performance data charts, mean effective temperature difference chart, determination of final dry bulb temperature and direct expansion coil surface temperatures, selection of direct expansion coils, direct expansion cooling coil capacity tables, and psychrometric chart as well as total heat table.

Complete with physical and dimensional data charts, piping diagrams and architectural and engineering specifications. Liberally illustrated. Request Catalog 5559.

Five Tankers Get Air Conditioning

HI-PRESS air conditioning systems will be installed on all five of the 715-foot, 48,580-ton tankers now on order for an affiliate of the Standard Oil Company of California at the new Odense, Denmark, shipyard, S. W. Brown president of Hi-Press Air Conditioning of America, Inc., announced.

The keel for the first of these tankers, on order for California Transport Corporation, already has been laid. The new shipyard, the Lindo plant of the Odense Steel Shipyard, Ltd., founded by A. P. Moller, one of Denmark's largest ship owners, is reputed to be one of the most modern in the world, with many labor-saving devices designed to hold down the costs of shipbuilding. International Hi-Press will handle installation of these air conditioning systems.

Hi-Press is a system of air conditioning, including cooling, heating and ventilating, which employs small diameter piping, instead of conventional ductwork, for the distribution of conditioned air at high pressures and high velocities.

The system, which is now handled by about 60 shipbuilding yards in Europe, the United States and Japan, was designed to effect substantial savings in initial installation and maintenance over conventional ductwork systems.

Catalog of Controls For Centrifugal Machines

››› CUTLER-HAMMER Inc., Milwaukee, has issued a 54-page booklet detailing the firm's control apparatus for hermetic centrifugal compressor applications.

Fully illustrated, the compact booklet provides a descriptive interpretation of basic controller selection considerations, the available types of reduced voltage and high voltage controllers, their individual operational and performance characteristics and, finally, their construction and design features.

Also included in the booklet are separate information sections devoted to auxiliary starting equipment, individual controller ratings and the writing of specifications.

To obtain copies, write Cutler-Hammer Inc., 488 N. 12th Street, Milwaukee, Wis. Specify publication ED-93.

New Literature On Flexible Connectors

››› A NEW technical catalog sheet has just been released on flexible metallic connectors by the Pennsylvania Flexible Metallic Tubing Company of Philadelphia, Pa.

This new catalog sheet is on the new Penflex Flexible Connectors which have been developed for use on pump installations, hot water systems and steam systems where thermal expansion and vibration are problems. It will be of particular interest to those in the air conditioning, refrigeration, power generation and those industries utilizing pumps to move hot materials. Catalog sheet gives full details, photos of connectors, construction and sizes available.

For copies of this literature write directly to Pennsylvania Flexible Metallic Tubing Company, 7200 Powers Lane, Philadelphia, Pa.

New Representative For Freezing Equipment Sales

››› THE appointment of Thomas B. Gilliam Co., 1925 Cedar Springs Road, Dallas 1, Tex., as their Southwestern representative for FES-Fuller rotary boosters is announced by officials of Freezing Equipment Sales, Inc. The new representative will specialize in refrigeration equipment.

Thomas B. Gilliam, owner-manager of the new company bearing his name, was formerly owner-manager of Western Ice Equipment Co. in San Francisco.

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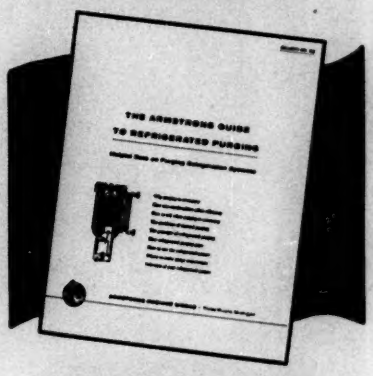

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All classified advertisements are payable in advance. Except for Positions and Help Wanted classifications, this section is reserved exclusively for USED equipment.

RATES: 20c per word; minimum 25 words. $2.00 per line for bold face headings: $15.00 per inch for line listings.

Position and Help Wanted

WANTED—Additional men to cover sales of water and brine treatment chemicals to ice plants. High commission basis. Chemical Solvent Company, P.O. Box 487, Birmingham, Ala.

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USED EQUIPMENT—wanted & for sale

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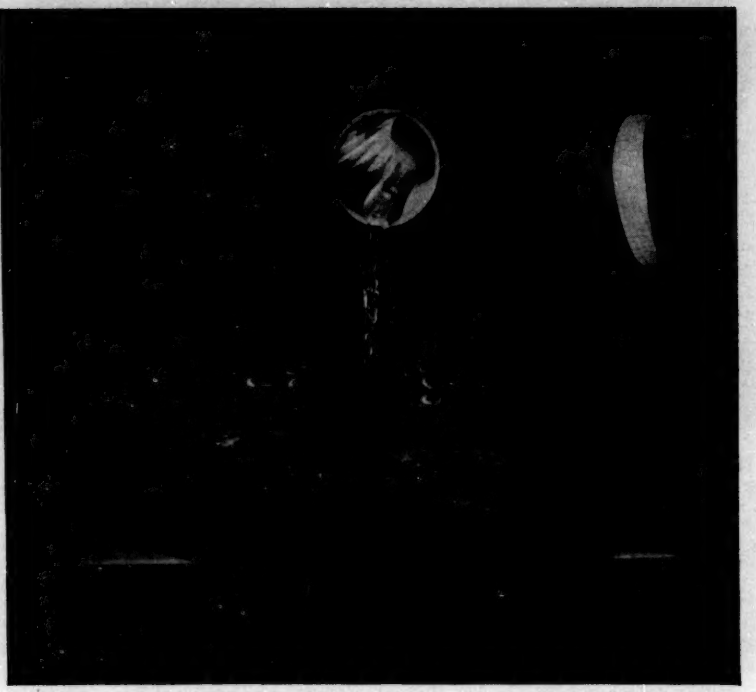
FOR SALE— York 7½x7½, York 8x8 Model D6, York 9x9 D6 compressors; complete with AC motor and starter; ammonia receivers, shell and tube condensers. Write for free listing. Chas. S. Jacobowitz Corp., 3080 Main St., Buffalo 14, N. Y. Phone AMherst 2100.

FOR SALE— Liquidating Leisy Brewery, Cleveland, Ohio, which ceased operations in December. 7 Vilter ammonia compressors, including those installed in 1950, all with synchronous motors from 10½x10½ down; also Vogt horizontal shell and tube condensers; everything still erected; purchase individual lots or whatever you require; thousands of feet of galvanized ammonia pipe, individual room coolers and other refrigeration equipment. Inspect at or communicate with Leisy Brewery, 3400 Vega Ave., Cleveland, Ohio. Phone MElrose 1-4100.



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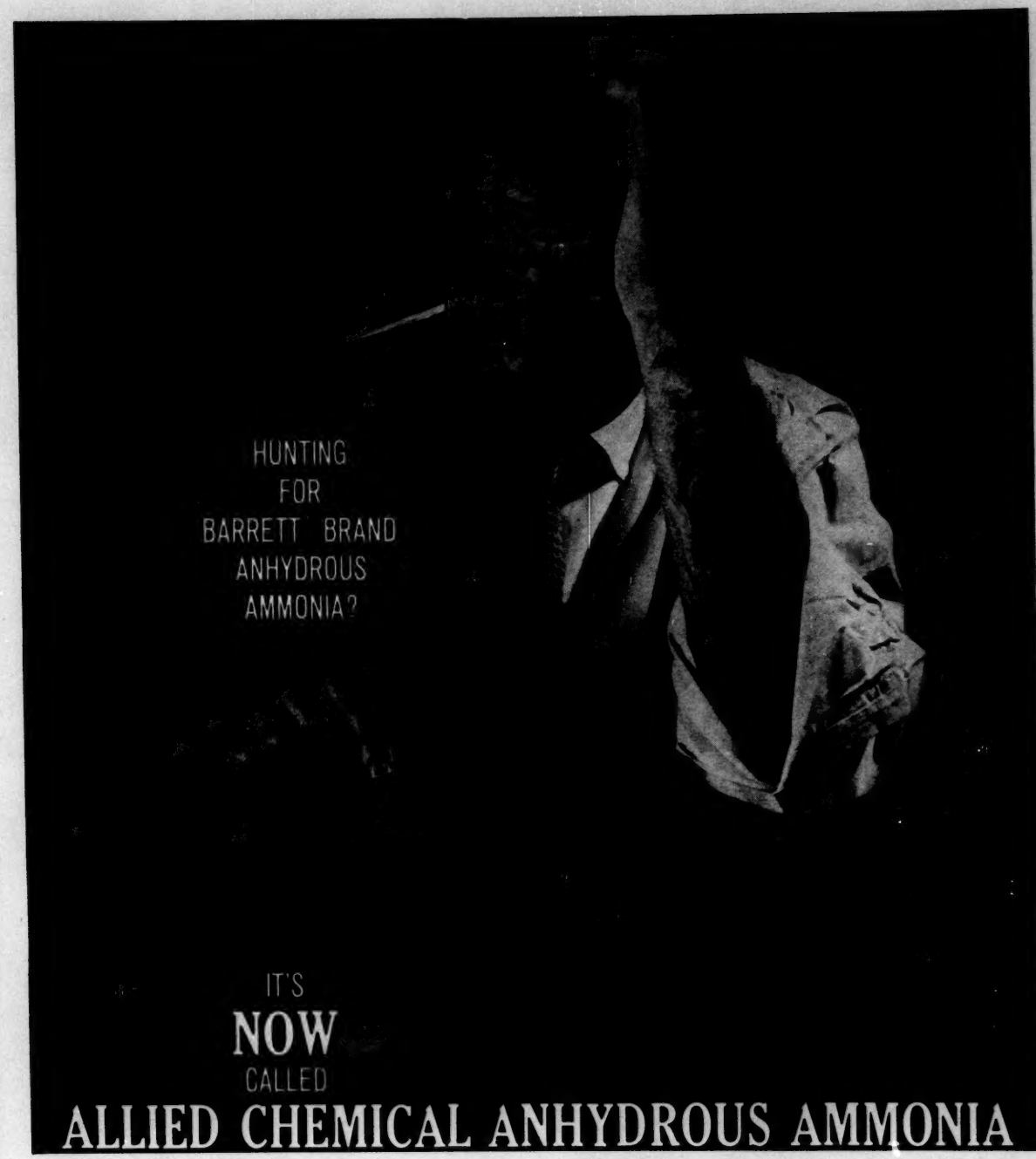

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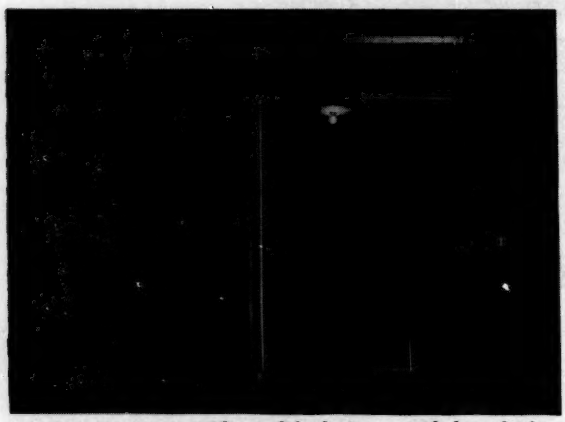

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